CITY OF SEAL BEACH
WATER MASTER PLAN UPDATE

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Submitted to

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SECTION 1

EXECUTIVE SUMMARY

1-1 History and Background

The City of Seal Beach was incorporated in 1915 and has been in operation under its own charter since 1964. It covers an area of 11.2 square miles along the Pacific coast in the northwest corner of Orange County. The City's total population was 24,168 in 2010 according to Census information. The California State Department of Finance estimated the City's population to be 24,215 in 2011.

1-2 Objectives and Scope of Work

The objective of this master plan is to evaluate the City's water supply system with the most current information and provide a framework for undertaking the construction of new and replacement facilities in an efficient manner.

1-3 Study Area

The City of Seal Beach is primarily a residential community located along the California coastline in western Orange County. It is bordered to the north by the City of Los Alamitos and the unincorporated Rossmoor community; to the east by the Cities of Garden Grove, Westminster, and Huntington Beach; to the south by the Pacific Ocean and City of Huntington Beach; and to the west by the City of Long Beach (Los Angeles County).

<u>Topographical Description</u>

The City is relatively flat, except in the Marina Hill Community, where the highest ground elevation is approximately 57 feet above mean sea level (amsl) along Crestview Avenue, between Crest Drive and Bayside Drive. The lowest ground elevation is sea level along the beach frontage.

<u>Geology</u>

The 1986 Orange County Hydrology Manual classifies the soils into four (4) hydrologic soil groups: "A", "B", "C", and "D". Several soil types underlie the study area, with the predominant soil type being silty-loam soils (Soil Group C), which impede downward movement of water.

<u>Climate</u>

The study area has a Mediterranean-like climate, enjoying plenty of sunshine throughout the year. The period of April through November is warm to hot and dry with high temperatures of 82 - 84°F and lows of 53 - 65°F. The coolest months are typically December and January, with an average minimum temperature of 46°F. Heaviest precipitation generally occurs between October and March. The average rainfall between the 1989/1999 fiscal year and the 2006/20007 fiscal year is 10.61 inches.

Land Use

Excluding the U.S. Naval Weapons Station, the City of Seal Beach is primarily a residential community with supporting commercial as well as light industrial and institutional land uses. The City is mostly developed with a mix of residential, commercial, industrial, and public land uses.

According to the 2011 California Department of Finance Housing Estimates, the total number of housing units within the City is 14,558 with a 10.59 percent vacancy rate.

Population

Since its incorporation in 1915, the City of Seal Beach has grown from a population of 250 to 24,215 in 2011 (California Department of Finance, Demographic Research Unit).

1-4 Water Use

Historic Water Production

The City purchases imported water from Metropolitan Water District of Southern California (MWD) through Municipal Water District of Orange County (MWDOC) and the West Orange County Water Board (WOCWB). The imported water supplements the groundwater that the City obtains from the Orange County Groundwater Basin through its four wells.

The total annual water purchase and groundwater from July 2001 to June 2011 is shown in Table 1-1. Over the last ten fiscal years, the annual imported water purchase has averaged 1,249 acre feet per year (AFY) {1.11 million gallons per day (mgd); 774 gallons per minute (gpm); 1.72 cubic feet per second (cfs)}, and the annual groundwater production has averaged 2,756 AFY {2.46 mgd; 1,708 gpm; 3.81 cfs}.

Table 1-1
Historical Imported Water Production and Groundwater Purchase (Annual)

				Groundwater											Total Water Use	
	Imported Water			Beverly Manor		Leisure		Bolsa Chica		Lampson		Total				
Fiscal Year	**(AFY)**	**(mgd)**	**(%)**	**(AFY)**	**(mgd)**	**(AFY)**	**(mgd)**	**(AFY)**	**(mgd)**	**(AFY)**	**(mgd)**	**(AFY)**	**(mgd)**	**(%)**	**(AFY)**	**(mgd)**
2001-2002	1,361	1.21	32%	790	0.71	690	0.62	1,434	1.28	-	-	2,914	2.60	68%	4,275	3.82
2002-2003	1,051	0.94	25%	954	0.85	502	0.45	1,639	1.46	-	-	3,095	2.76	75%	4,146	3.70
2003-2004	1,173	1.05	27%	1,076	0.96	400	0.36	1,664	1.49	-	-	3,140	2.80	73%	4,313	3.85
2004-2005	1,505	1.34	38%	847	0.76	378	0.34	1,247	1.11	-	-	2,472	2.21	62%	3,978	3.55
2005-2006	1,408	1.26	36%	942	0.84	168	0.15	1,408	1.26	-	-	2,518	2.25	64%	3,927	3.51
2006-2007	1,141	1.02	27%	1,191	1.06	265	0.24	1,706	1.52	-	-	3,162	2.82	73%	4,303	3.84
2007-2008	919	0.82	23%	1,019	0.91	444	0.40	1,645	1.47	-	-	3,107	2.77	77%	4,026	3.59
2008-2009	1,180	1.05	30%	701	0.63	510	0.45	1,521	1.36	-	-	2,731	2.44	70%	3,911	3.49
2009-2010	1,456	1.30	40%	436	0.39	340	0.30	1,445	1.29	-	-	2,221	1.98	60%	3,678	3.28
2010-2011	1,294	1.16	37%	405	0.36	453	0.40	1,208	1.08	139	0.12	2,203	1.97	63%	3,498	3.12
Average	**1,249**	**1.11**	**31%**	**836**	**0.75**	**415**	**0.37**	**1,492**	**1.33**	**139**	**0.12**	**2,756**	**2.46**	**69%**	**4,005**	**3.58**

**Water Data from Seal Beach Water Department*

Since the 2006-2007 fiscal year, the City's total water use has declined from 4,303 AFY to 3,498 AFY. This reduction is primarily due to a conscientious water conservation effort by the City and its residents

Water Consumption versus Water Purchase/Production

The City's consumption records from July 2009 to June 2010 were reviewed for the purposes of this master plan. The Citywide average consumption was estimated at 3,615 AFY {3.22 mgd, 2,240 gpm, 4.99 cfs}.

Unaccounted for water is the difference between the purchase/production and the sum of the individual customers' consumption. The City typically purchases and produces more water than the quantity measured by the customer meters. Unaccounted for water may be partly due to the differences in the accuracies of the large meters which measure purchase and production, and the thousands of small customer meters which measure sales. Water losses can also be due to unmeasured uses such as water main flushing and other maintenance related tasks and water leaks.

The water purchase and production records from July 2009 to June 2010 totaled 3,678 AFY {3.28 mgd, 2,278 gpm, 5.08 gpm}. During this study period, approximately 1.7 percent of the water supply was unaccounted for. This is well within the 10 percent or less industry standard for unaccounted for water.

Monthly Demand Variations

Typical of most Southern California communities, the City's water consumption exhibits a distinct seasonal pattern. Peak and low monthly consumption occur during the dry summer months and wet winter months, respectively. The highest and lowest monthly demand factors are 1.36 in August 2007 and 0.59 in February 2010, respectively.

Hourly Demand Variations

The total system diurnal curve exhibits two peaks. The main peak factor is approximately 1.93 and occurs in the early morning around 1:15 a.m. This peak factor is attributed to high irrigation water usage within the Leisure World community, which provides the majority of the irrigation between 12:00 a.m. and 5:00 a.m. to minimize any inconvenience to the community residents. The second peak factor is approximately 1.39 and occurs around 7:00 a.m. which is typical for a primarily residential community. Two diurnal curves were developed for this study.

Currently, heavy water usage occurs in the Leisure World community for irrigation between 12:00 a.m. and 5:00 a.m. The demands remain relatively constant throughout the remainder of the day between 6:00 a.m. and 12:00 a.m. The peak hour demand is approximately 3.84 times the daily average at about 12:45 a.m.

The demand pattern for the remainder of the City is quite typical of predominately residential service areas, with the peak demands occurring between 6:00 a.m. and 9:00 a.m. The peak hour demand for this portion of the system is 1.68 times the daily average and occurs at about 7:00 a.m.

System Demand and Peaking Factors

Typically, a water system is designed to meet the maximum demands placed on it. The system components must be designed to cope with these demands as they occur. Maximum month and maximum day demands are important factors in sizing a system's supply capability. Maximum day demands usually dictate the design criteria for both system transmission and storage needs. Peak hour criterion is a measure of the system's overall adequacy with respect to its transmission and distribution elements. The City of Seal Beach's water system demands utilized in this study are shown in Table 1-2.

Table 1-2
Water System Demands and Peaking Factors

Demand Descripti	Existing Demand			Peaking Factor
	(gpm)	(mgd)	(AFY)	
Average Day	2,169	3.12	3,498	1.00
Max Month	3,036	4.37	4,897	1.40
Max Week	3,687	5.31	5,947	1.70
Max Day	4,120	5.93	6,646	1.90
Peak Hour	7,960	11.46	12,839	3.67

Ultimate Demands

The City has identified one (1) planned area in Old Town community southwest of Marina Drive and First Street. The Bay City Partners LLC currently owns this property and proposes constructing a development that includes 48 residential units and 6.4 acres of open space land.

Because the City is nearly developed, large increases in population and water demands are not expected. It is expected that any incremental increase in population and therefore water demands will be offset by the City's proactive and rigorous conservation efforts (See Section 4-10). Therefore, the ultimate demands are expected to be similar to the existing demands for this study.

Water Conservation

Water conservation will continue to be an important issue as California's water storage and supply remain at critically low levels and as legislative mandates for reduced water consumption become law. The Water Conservation Act of 2009 (SBx7-7), was adopted in November 2009 to reduce the agricultural and urban water use throughout the State of California. The goal is to reach a 20 percent overall reduction in urban per capita water use statewide on or before December 31, 2020.

Per the City's *2010 Urban Water Management Plan*, the baseline daily per capita water use is set at 151.7 gallons per day per capita (gpcd). The City's 2020 target is 139.5 gpcd. This is an eight percent decrease in per capita water use. To achieve this target, the City plans to continue its water conservation effort with its existing demand management measures.

1-5 Water Supply

Sources of Supply

The City's potable water supply consists of imported water from Metropolitan Water District of Southern California (MWD) through Municipal Water District of Orange County (MWDOC) and the West Orange County

Water Board (WOCWB) and groundwater from the Orange County Groundwater Basin through the City's four (4) wells.

Imported Water Supply

MWD is the purveyor of imported water for most of Southern California. It provides supplemental water to 26 member public agencies through a regional distribution network of canals, pipelines, reservoirs, treatment plants, pump stations, hydropower plants and other appurtenances

Imported water is supplied to Seal Beach by the Municipal Water District of Orange County (MWDOC) via the West Orange County Water Board (WOCWB), which is a joint powers agency formed in 1955 for the purpose of providing a dependable imported water supply to its member agencies. The City of Huntington Beach operates the WOCWB system under contract to the Board, and communicates with MWDOC and MWD for the requested flows.

Groundwater Supply

The City of Seal Beach has four (4) active wells, which provide groundwater from the Main Orange County Groundwater Basin. The groundwater basin is approximately 229,000 acres in size and has historically provided over 300,000 AFY to the residents of Orange County.

1-6 Existing Water System

The City of Seal Beach's domestic water system consists of the following:

- 73.4 Miles of pipe ranging in size from 4-inches to 20-inches in diameter
- 2 Booster pump stations (Navy and Beverly Manor)
- 2 Forebay reservoirs with a total capacity of 7 million gallons (Navy and Beverly Manor)
- 4 Active wells (Leisure World, Beverly Manor, Bolsa Chica, and Lampson Avenue)
- 1 Imported water supply connection (West Orange County Water Board {WOCWB} through Metropolitan Water District OC-35 Connection)
- Emergency connections with the City of Long Beach, the City of Huntington Beach, the City of Westminster, and the Golden State Water Company
- Partially completed SCADA system
- 680 fire hydrants
- Approximately 5,677 potable water services

Pressure Zones

Aside from the Marina Hill community, the study area is generally characterized by flat terrain. Therefore, multiple pressure zones are not required. The City's water system is a single zone closed system without a free-water surface. System pressure is maintained through the pressure at the imported water supply connection, and the pumping at varying speeds based upon demand at the (2) booster pump stations, Bolsa Chica Well, and Lampson Avenue Well.

Transmission and Distribution System

The potable water system includes 387,690 feet (73.4 miles) of transmission and distribution system pipes ranging in size from 4-inches to 20-inches in diameter. Less than 2 percent of these mains are 4-inches in diameter. Approximately 6 percent of the system was constructed before 1960. Approximately 55 percent of the system was installed during the 1960's, and 22 percent in the 1970's. Approximately 75% of the system is asbestos cement pipe (ACP).

Emergency Connections

The City has emergency connections with the City of Long Beach, the City of Huntington Beach, the City of Westminster, and the Golden State Water Company. These emergency connections should not be relied on as primary sources of supply, but only for emergencies.

Wells

The City of Seal Beach has four (4) active wells, which pump groundwater from the Main Orange County Groundwater Basin. A summary of the existing groundwater supply is provided in Table 1-3.

Table 1-3
Existing Groundwater Supply Sources

Source	Type	Pump Stages	Design		Disinfection	Driver	
			Capacity	TDH (ft)			
Bolsa Chica Well	Local	5	3,000 gpm (4.32 mgd)	300	On-site Sodium Hypochlorite Generator	400 HP Electric Motor w/Variable Speed Drive	525 HP Natural Gas Engine
Beverly Manor Well	Local	4	2,100 gpm (3.02 mgd)	252	On-site Sodium Hypochlorite Generator	N/A	100 HP Natural Gas Engine
Leisure World Well	Local	3	3,600 gpm (5.18 mgd)	153	Sodium Hypochlorite Generator at Beverly Manor Booster Station	250 HP Electric Motor	N/A
Lampson Avenue Well	Local	4	3,000 gpm (4.32 mgd)	512	On-site Sodium Hypochlorite Generator at Lampson Avenue Station	500 HP Electric Motor w/Variable Speed Drive	N/A

Booster Pump Stations

The City's water system relies greatly on its two existing booster pump stations to provide adequate system pressures. The two storage reservoirs act as forebay storage to the booster pump stations.

Navy Booster Station **–** The Navy Booster Station pressurizes the distribution system in the Old Town and Marina Hill communities during high demand periods. The Navy Booster Station was constructed in 1963 and upgraded in 2007. The pump station and reservoir are located within the U.S. Naval Weapons Station, east of Seal Beach Boulevard and north of Bolsa Avenue.

Beverly Manor Booster Station – Beverly Manor Booster Station is located south of the San Diego Freeway and west of Seal Beach Boulevard. The Beverly Manor Pump Station was constructed in 1969. It is located in the same structure as the Beverly Manor Well.

<u>Reservoirs</u>

The City of Seal Beach owns two forebay reservoirs with a total capacity of 7 MG and a usable capacity of 6.3 MG.

1-7 Service Criteria

Performance criteria is established to evaluate the adequacy of various water system components through a systematic analysis and to identify necessary improvements to the system for inclusion in a Capital Improvement Program (CIP). Some criteria, such as service pressures, storage capacity, and sources of supply are based upon experience and their application is at the discretion of the water purveyor. For the City, these criteria are generally in accordance with the California Code of Regulations, Title 22. Other criteria, such as water quality and fire protection, are based on federal, state and local jurisdictional requirements. A summary of the service criteria for Seal Beach's system is listed in Table 1-4.

Table 1-4
Service Criteria

Description	Criteria	Existing Requirement
1. Source of Supply		
a. Total	Maximum Day Demand	4,120 gpm (5.93 mgd)
b. Local Supply	Average Day Demand	2,169 gpm (3.12 mgd)
2. Reservoir Capacity		
a. Operational Storage	35% of Maximum Day Demand (includes an increase of 15% for submergence over the reservoir outlet pipe)	2.38 MG
b. Emergency Storage	Seventy Percent of Seven (7) Average Day Demand less local groundwater well capacity	N.A.
c. Fire Suppression	Includes an increase of 15% for submergence over the reservoir outlet pipe	
Single Family Residential	2,000 gpm for 2 hours (plus 15%)	0.28 MG
Multi-Family Residential	3,000 gpm for 4 hours (plus 15%)	0.83 MG
Schools	3,500 gpm for 4 hours (plus 15%)	0.97 MG

Commercial / Industrial	4,000 gpm for 4 hours (plus 15%)	1.10 MG
3. Booster Pump Stations	Firm Capacity including well capacity directly pumped into the system, must deliver Maximum Day Demand plus Fire Flow Demand or Peak Hour Demand, whichever is greater	
	Stand-by pump equal in size to the largest duty pump	
	Flow meters, suction and discharge pressure gauges, and telemetry equipment for alarm and status notification at each station	
	Provisions for emergency power at all stations	
4. Minimum Pipe Size	6-inch	
5. Maximum Velocities	6 fps at peak flows (5 fps for PVC)	
	10 fps at Fire Flow Demand	
6. Static Pressures	Minimum 50 psi	
	Desired 60-80 psi	
	Maximum 100 psi	
7. Dynamic Pressures	Minimum 40 psi during Maximum Day Demand	
8. Fire Flow Demands		
a. Single Family Residential	2,000 gpm for 2 hours with 20 psi residual pressure at fire hydrant	0.24 MG
b. Multi-Family Residential	3,000 gpm for 4 hours with 20 psi residual pressure at fire hydrant	0.72 MG
c. Schools	3,500 gpm for 4 hours with 20 psi residual pressure at fire hydrant	0.84 MG
d. Commercial / Industrial	4,000 gpm for 4 hours with 20 psi residual pressure at fire hydrant	0.96 MG

Water Quality

The quality of water served by the City has to be in accordance with the Federal standards as well as the State of California Department of Public Health (CDPH) standards as set forth in Title 22 of the California Code of Regulations.

The basic water quality standards are established by the Safe Drinking Water Act (SDWA), which was passed by the Congress in 1974. Amendments to the SDWA were enacted in 1986 and 1996. The SDWA mandated the U.S. Environmental Protection Agency (EPA) to develop primary drinking water standards or maximum contaminant levels (MCL'S) in public water supplies.

The CDPH has the responsibility for the State's drinking water program. It is accountable to the EPA for enforcement of the SDWA and for adoption of standards that are at least as stringent as that of the EPA. Since California conducts independent risk assessments, some of its standards are more stringent than the standards of the Federal Government.

Water quality requirements are described in detail in Section 7 of this report.

1-8 Hydraulic Model

A computer model of the City's water system was utilized to aid in the evaluation of the adequacy of the existing facilities.

The features included in the water model are as follows:

- 73.4 miles of transmission and distribution mains, 4-inches to 20-inches in diameter
- 2 Booster pump stations (Navy and Beverly Manor), 5 pumps total
- 4 Active wells (Leisure World, Beverly Manor, Bolsa Chica, and Lampson Avenue), 4 pumps total
- 2 Forebay reservoirs with a total capacity of 7 million gallons (Navy and Beverly Manor)
- 1 altitude valve (Navy Reservoir)
- 1 WOCWB connection
- 680 fire hydrants

The demand distribution, diurnal curves, friction coefficients, and pressure controls, were inputted in the City's model to perform the hydraulic analyses.

<u>Model Calibration</u>

The existing water system model was calibrated by closely matching the demands and pressures to field measured values. The resulting model can be used to analyze the system under various operating conditions. The selected calibration day was Monday June 6, 2011.

Demands - The total system demand was set to 3,068 gpm, which was the calculated daily production for the calibration day.

Pressure Controls - The Bolsa Chica Well and the Lampson Avenue Well were operated during the calibration day. The Navy Booster Pump Station is operated to maintain pressure in the south part of the City during the high demand periods.

Field Data – Supervisory Control and Data Acquisition (SCADA) data and pressure information was collected from June 3, 2011 to June 13, 2011 and used in calibrating the 24-hour extended period simulation. Pressure data loggers were installed on fire hydrants at 12 locations throughout the system. The selected locations were scattered throughout the service area in order to obtain representative pressure measurements in all areas of the system.

Calibration Results - The difference between measured pressures and the model output range from 0.2 psi to 3.4 psi. The average difference for all pressure readings was 1.8 psi. The percentage differences ranged from 0.3 percent to 5.2 percent. On average, the percentage difference was 2.9 percent. Typically, pressure differences of 5 percent and less are considered to be good indicators of the model's overall accuracy

Hydrant Flow Testing- Hydrant flow testing was conducted in the field on Wednesday, February 1, 2012 to further refine the calibrated model. The field testing was performed at seven (7) hydrants by City and AKM staff. Portable pressure gauges were set up on two (2) nearby hydrants in the vicinity of the flow hydrant. The static pressures were recorded at each flow hydrant and the nearby hydrants. When the flow hydrant was opened, the available flows were recorded and the residual pressures were recorded at the two (2) nearby hydrants. The model was adjusted to reflect the conditions of the hydrant flow testing day. The City-wide demands, facility flows, facility pressures, and hydrant flows were input into the model to reflect the actual real-time field results. Following the field flow testing, the recorded pressures were compared to the model results. If the difference in the pressure drop between the field results and the model results were less than 5 psi, the model was considered to be representative of the existing system. The model is considered to be representative of the existing system.

1-9 System Evaluation

The established system criteria, calibrated system computer model, and condition assessment were utilized in analyzing the system, and evaluating its adequacy. The system model was utilized to analyze the existing system under average day, maximum day, peak hour, and maximum day plus fire flow conditions.

Existing system deficiencies were identified and mitigation projects were formulated based upon the results of the model runs and input from City staff. Proposed projects were added in the hydraulic model to test the operation of the system after their implementation.

A capital improvement program was developed as a result of these analyses. Recommended projects and cost estimates are discussed in Section 10 of this Master Plan Report.

Source of Supply

The criterion for source of supply is providing one maximum day demand (4,120 gpm). The City is fortunate to have access to groundwater from the Orange County Main Groundwater Basin, which is managed by OCWD. One hundred percent (100%) of the City's maximum day demands can be supplied by a combination of the four (4) groundwater wells, even if imported water is unavailable.

If groundwater is unavailable, the City can supply the maximum day demands with the maximum available imported water supply from WOCWB (10 cfs or 4,488 gpm), which is 109 percent of the maximum day demand.

Storage

For a water system such as the City's, three (3) categories of storage are of importance: fire suppression, operational, and emergency. The total storage is summarized below:

Fire Suppression	1.10 MG
Operational	2.38 MG
Emergency (Available from Groundwater)	0 MG
Total	**3.48 MG**

The two existing reservoirs have a total usable volume of 6.3 MG, which is significantly greater than the required total storage. To further increase its reliability, the City has the capability of utilizing its emergency connections with the City of Long Beach, the City of Huntington Beach, and the Golden State Water Company.

The City currently does not require any additional storage. Whenever either reservoir is scheduled to be replaced, the City should reevaluate its water usage, operations, and redevelopment plans to determine if additional storage may be required.

Model Runs and System Pressures

The hydraulic model was utilized to analyze the existing system under average day, maximum day, peak hour, and maximum day plus fire flow conditions.

The hydraulic model was used to analyze six (6) scenarios, which consisted of different combinations of the City's water sources: Lampson Avenue Well, Bolsa Chica Well, WOCWB turnout, and the Beverly Manor Booster Pump Station (supplied by Beverly Manor Well and Leisure World Well). All analyses were run with the Navy Booster Pump Station in operation. The pressure ranges for each of these scenarios under average day, maximum day, and peak hour maximum day demands is summarized in Table 1-5.

Table 1-5
Scenario System Pressures

Scenario	Facilities in Operation	Average Day Demands		Maximum Day Demands		Peak Hour Maximum Day Demands	
		Pressure Range (psi)	Satisfy 40 psi Requirement?	Pressure Range (psi)	Satisfy 40 psi Requirement?	Pressure Range (psi)	Satisfy 40 psi Requirement?
1	Beverly Manor Booster Pump Station WOCWB Connection	48-77 psi	Yes	47-76 psi	Yes	38-67 psi	Low pressures are experienced in the Marina Hill area only during the early morning hours due to the high irrigational usage by the Leisure World Community.
2	Beverly Manor Booster Pump Station Bolsa Chica Well	49-78 psi	Yes	48-77 psi	Yes	42-71 psi	Yes
3	Lampson Avenue Well Bolsa Chica Well	48-77 psi	Yes	46-76 psi	Yes	32-68 psi	Low pressures are experienced in the Marina Hill area only during the early morning hours due to the high irrigational usage by the Leisure World Community.
4	Lampson Avenue Well Beverly Manor Pump Station	48-77 psi	Yes	46-76 psi	Yes	38-68 psi	Low pressures are experienced in the Marina Hill area only during the early morning hours due to the high irrigational usage by the Leisure World Community.
5	Bolsa Chica Well WOCWB Connection	48-77 psi	Yes	46-75 psi	Yes	38-67 psi	Low pressures are experienced in the Marina Hill area only during the early morning hours due to the high irrigational usage by the Leisure World Community.
6	Lampson Avenue Well WOCWB Connection	48-77 psi	Yes	46-75 psi	Yes	39-69 psi	Low pressures are experienced in the Marina Hill area only during the early morning hours due to the high irrigational usage by the Leisure World Community.

Average Day Demand - Pressures during average day demands were above the City's dynamic pressure criteria (40 psi) throughout the service area.

Maximum Day Demand - The maximum day demand for each of the 6 scenarios did not indicate any hydraulic deficiencies. System pressures range from 46 psi in the Marina Hill area to 77 psi near the Aquatic Park.

Maximum Day Peak Hour Demand – The maximum day peak hour pressures are slightly less than the 40 psi criteria. These low pressures occur in the Marina Hill area during peak hour irrigation usage in Leisure World at around 1:15 a.m., when the majority of the residents are asleep. During the typical residential peak hour at 7:00 a.m., the hydraulic model indicates that the system is capable of providing the 40 psi requirement in the Marina Hill area. Should low pressures become a common occurrence, the City may consider utilizing a third source of water during the maximum month water usage periods.

Maximum Day Demand plus Fire Flow - The fire flow criterion requires a residual pressure of 20 psi at the fire hydrant outlet. The maximum day demand plus fire flow scenarios revealed one (1) deficiency in the system where the required residual pressure could not be met.

Since the analyses were conducted for the maximum day period, the model was set up with the Beverly Manor Well, Beverly Manor Booster Pump Station, Navy Booster Pump Station and the MWD connection in operation. During a fire flow event, the low pressures at the Lampson Avenue Well or Bolsa Chica Well would be less than their emergency settings of 40 psi and 38 psi, respectively. As discussed in Section 8-5, the facilities will respond to provide the necessary water. For the fire flow analysis, the model was also set up with the Lampson Avenue Well placed into operation.

Fire flow was applied at each hydrant in accordance with the California Fire Code (Table 105.1) and the criteria established in Section 7-11. In summary, the fire flow applied in a single family residential area is 2,000 gpm; in a multi- family residential area is 3,000 gpm; near a school is 3,500 gpm; in a commercial or industrial area is 4,000 gpm. If two land uses are present in the same area, the higher fire flow was used.

For most of the model analyses, fire flow was taken at more than one hydrant. This is especially necessary in commercial and industrial areas where the criterion is 4,000 gpm. The maximum day plus fire flow run resulted in one deficiency. The residential fire flow demand of 2,000 gpm cannot be provided at the 6-inch dead end on Harvard Lane, north of Dartmouth Circle. To improve the fire flow demands at this location, it is recommended that the City provide the following improvements:

- Provide an emergency connection with the City of Long Beach at College Park Drive, west of the San Gabriel River
- Replace 471 feet of 6-inch with 8-inch pipe

<u>Transmission and Distribution System</u>

The existing distribution pipes are generally well looped throughout the system, providing redundancy as well as reliability.

The system velocities are generally within an acceptable range during the average and maximum day demand periods. During maximum day demands, the maximum velocity is almost 6.2 ft/s near the northern Leisure World connection and meter, which is slightly greater than the 6 ft/s criteria.

Minor velocity deficiencies are experienced during maximum day plus fire flow analyses. The existing 8-inch suction and discharge pipes at Navy Booster Pump Station may experience velocities greater than the 10 fps criteria, if a 4,000 gpm fire flow is required in the southern portion of the City. Other velocity deficiencies may occur at dead end pipes during a fire flow event.

The expected useful life of the City's water facilities are discussed in Section 9-5. Approximately 29,189 feet (5.5 miles or 8% of the total system) of pipe are currently older than the expected useful life. An aggressive annual replacement program is needed to tend to the aging pipes. Many of the pipes in the Old Town community may be over 90 years old. The replacement program for these pipes have been broken down into two (2) phases. Phase 1 is of greater priority and consists of 4,152 feet of pipe, which the City has identified being in poor condition. Phase 2 consists of the remaining 24,795 feet of pipe in the Old Town community. The Phase 2 projects should be scheduled on a yearly basis, to accommodate the City's available budget. The City may take advantage of concurrent construction such as street paving or adjacent infrastructure work when determining the priority of the Phase 2 improvements. There is 1,213 feet of pipe outside the Old Town community that have exceeded their expected useful lives. These pipes have been addressed directly in the Capital Improvement Program. The City should verify the pipe material and condition of the pipes that have exceeded their expected useful lives before initiating the pipeline replacement.

Water Age Analysis

The existing system model was used to determine the age of the water in the system. Water that remains in a reservoir or in an oversized pipe for an extended period of time may be susceptible to water quality problems such as trihalomethanes, haloacetic acids, and nitrification.

The hydraulic model was utilized to determine the water age in the system. The existing water system was analyzed with average day demands. The average water age in the Navy Reservoir and Beverly Manor Reservoir were estimated as 80 hours (3.3 days) and 84 hours (3.5 days) respectively. The model estimated that the greatest average water age was approximately 126 hours (5.3 days) in the Sunset Beach community. From the introduction into the City's system from the City's wells, it is anticipated that it will take approximately 5.3 days to circulate the water to the Sunset Beach community, which is located the furthest from the City's wells.

The City is in compliance with all Federal and State water quality standards, including those for TTHM and HAA5, which indicate that the City does not have any problems water age in the system.

1-10 Capital Improvement Program

The Capital Improvement Program (CIP) consists of projects that will enhance the system to meet the established criteria, properly maintain the system's assets, and replace the facilities that have reached the end of their expected useful lives. The goal of the CIP is to provide the City with a long-range planning tool that will allow construction of the recommended projects in an orderly manner to improve the existing system and provide for any future growth. In order to accomplish this goal, it is necessary to determine the estimated cost of the needed water system improvements identified in this study, establish a basis and prioritize each of the projects. The recommended CIP is shown in Table 1-6. Project locations are shown on Figure 1-1.

Cost estimates have been prepared for each recommended project, based upon information from recent similar projects. The pipeline replacement costs are generally based upon $50 per diameter inch per foot for the Old Town area and $35 per diameter inch per foot for the remaining areas of the City. The City of Seal Beach is mostly developed, and there are many existing utilities to consider in future pipeline replacement projects. Therefore, the costs of replacing water facilities will be generally higher than in an area that is undeveloped. Construction costs can be expected to fluctuate as changes occur in the economy. These costs should therefore be reevaluated and updated annually based upon Engineering News Record (ENR) Index for the Los Angeles area (ENRLA), with the base ENRLA Index of 10,300 for June 2012.

It should be noted that some of the improvements recommended herein are conceptual in nature based on existing planning information. Therefore, they should not be considered as absolute for final design. Further analysis and refinement will be necessary prior to commencing work on the final plans, specifications and estimates package for each project. **Detailed preliminary design studies should be prepared to select the final design projects.**

The cost estimates that follow were generated by estimating the quantities of required items for each improvement, and applying typical unit prices to obtain the total estimated construction costs. An amount equal to 40 percent is added to the construction cost estimates to cover contingencies, project design, administration, and construction duration services. The resultant sum is the total estimated project cost. Cost estimates for each recommended project are shown in Table 1-6. The total Capital Improvement Program cost is estimated at $33,531,000.

Table 1-6
Capital Improvement Program

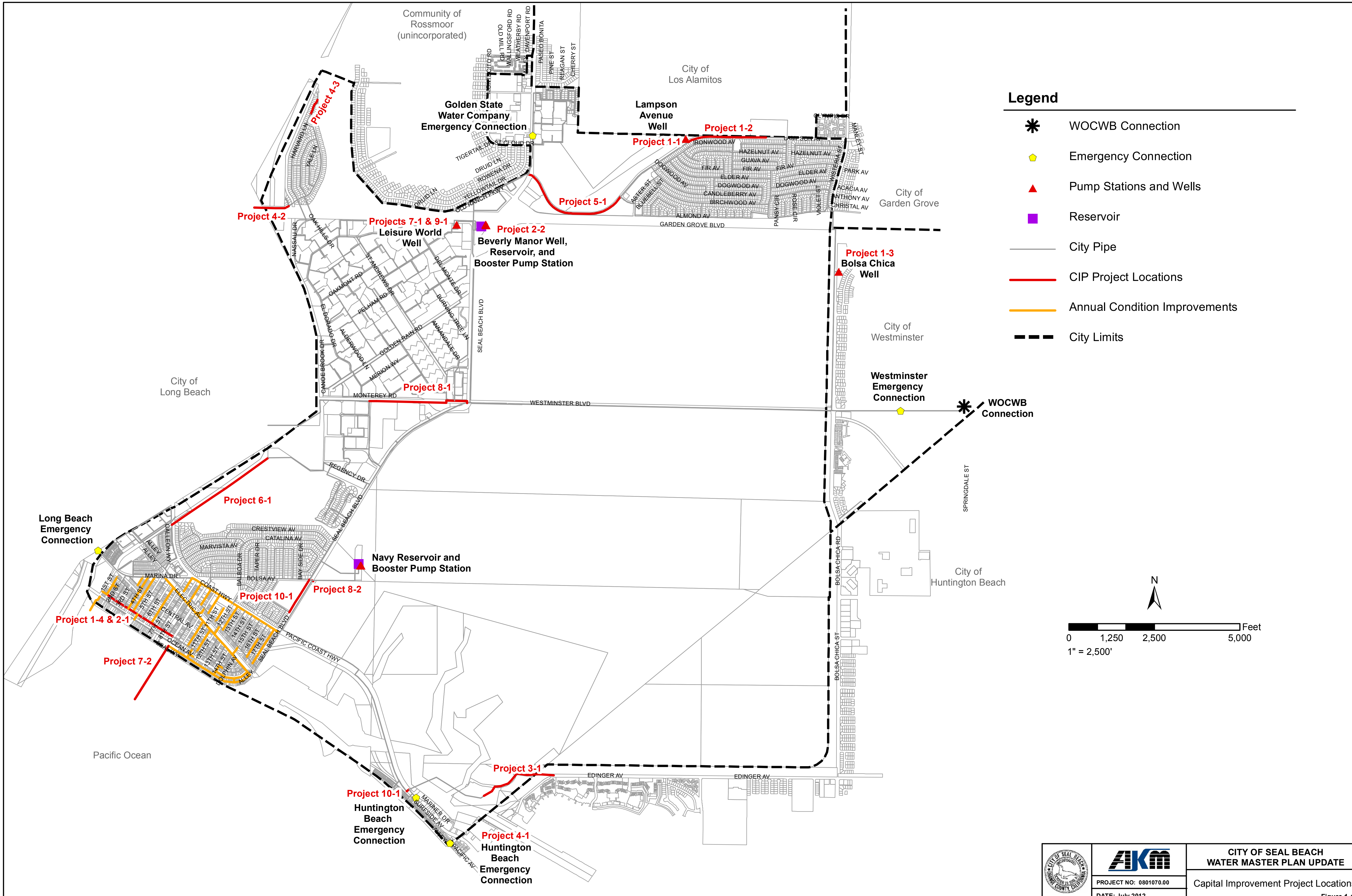
Year of Implementation	Project ID	Location	Justification	Pipe ID	Year of Construction	Material	Existing Size (in)	Ult. Size (in)	Length (ft)	Unit Cost ($)		Construction Cost ($)	Total Cost ($)
2012	1-1	Lampson Avenue Well 750KW Emergency Generator	Source of Supply Reliability	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	300,000	Each	**$300,000**	**$420,000**
2012	1-2	Lampson Avenue Well Discharge Piping - Lampson Avenue, between Lampson Avenue Well and east of Heather Street	Source of Supply Reliability	New	N.A.	N.A.	N.A.	12	1,326	35	Diam/in/LF	$556,920	$779,688
								8	979	35	Diam/in/LF	$274,120	$383,768
		Totals							**2,305**			**$831,040**	**$1,163,456**
2012	1-3	Bolsa Chica Well SCADA Improvement	Asset Maintenance	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	30,000	Each	$30,000	$42,000
		Bolsa Chica Well 400 HP Motor Replacement	Asset Maintenance	1995	N.A.	N.A.	N.A.	N.A.	N.A.	125,000	Each	$125,000	$175,000
		Totals							**0**			**$155,000**	**$217,000**
2012-2013	1-4 & 2-1	Old Town Water Line Replacement, Phase 1 -Ocean Alley Improvement	Age/ Condition	P3662	1903	CIP	6	8	127	50	Diam/in/LF	$50,858	$71,202
				P3260	1903	CIP	4	8	140	50	Diam/in/LF	$56,035	$78,449
				P3660 P3552 P3550 P3530 P3492 P3490 P3480 P3370 P3362 P3360 P3310 P3482	1903	ACP	8	8	2,042	50	Diam/in/LF	$816,964	$1,143,749
		Totals							**2,310**			**$923,857**	**$1,293,400**
2013	2-2	Beverly Manor Reservoir Access Hatch and Ladder	Asset Maintenance	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	40,000	Each	$40,000	$56,000
		Beverly Manor Booster Pump Station and Well Improvements	Asset Replacement	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3,200,000	Each	$3,200,000	$3,200,000
		Leisure World Well SCADA Improvements	Asset Maintenance	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	50,000	Each	$50,000	$70,000
		Totals							**0**			**$3,290,000**	**$3,326,000**

Table 1-6 (Continued)
Capital Improvement Program

Year of Implementation	Project ID	Location	Justification	Pipe ID	Year of Construction	Material	Existing Size (in)	Ult. Size (in)	Length (ft)	Unit Cost ($)		Construction Cost ($)	Total Cost ($)
2014	3-1	Sunset Aquatic Park Connection	Secondary supply to unreliable waterline under Anaheim Bay, possibly transfer service to Huntington Beach	New	N.A.	N.A.	N.A.	12	2,000	35	Diam/in/LF	$840,000	$1,176,000
								12" Bridge Crossing	400	1,000	LF	$400,000	$560,000
								Connection	N.A.	100,000	Each	$100,000	$140,000
		Totals							**2,400**			**$1,340,000**	**$1,876,000**
2015	4-1	Huntington Beach Automatic Connection	Redundancy	N.A.	N.A.	N.A.	N.A.	Connection	N.A.	200,000	Each	**$200,000**	**$280,000**
2015	4-2	College Park West Emergency Connection to Long Beach system	Provide service during outage of City supply pipes	New	N.A.	N.A.	N.A.	8	700	35	Diam/in/LF	$196,000	$274,400
								8" Bridge Crossing	400	1,000	LF	$400,000	$560,000
								Connection	N.A.	100,000	Each	$100,000	$140,000
		Totals							**1,100**			**$696,000**	**$974,400**
2015	4-3	Harvard Lane, north of College Park Drive	Fire Flow Deficiency	P6014	1971	ACP	6	8	471	35	Diam/in/LF	**$131,897**	**$184,656**
2016	5-1	Lampson Avenue, between Seal Beach Boulevard and Basswood Street	Age/ Condition	P1000 P1010 P1020 P1030 P1040	1979	Mortar Lined Steel Cylinder	12	16	3,406	35	Diam/in/LF	**$1,907,631**	**$2,670,683**
2017	6-1	Pacific Coast Highway and OCFCD Los Alamitos Retarding Basin	Age/ Condition	P7430 P7440 P7450 P7452	1968	Mortar Lined Steel Cylinder	18	18	3,420	35	Diam/in/LF	**$2,154,715**	**$3,016,601**
2018	7-1	Leisure World Well Discharge Piping	Age/ Condition	N.A.	1962	ACP	12	12	77	35	LF	$32,340	$45,276
				N.A.	1962	N.A.	N.A.	Sand Separator	N.A.	100,000	Each	$100,000	$140,000
		Totals							**77**			**$132,340**	**$185,276**
2018	7-2	Old Town Water Line Replacement, Phase 1 - Pier Fire Line	Condition	P3060	1974	Mortar Lined Steel	6	8	1,842	50	Diam/in/LF	$736,967	**$1,031,754**
2019	8-1	Westminster Boulevard Water Line Replacement, from Seal Beach Boulevard to Apollo Drive	Condition	P7340 P7350 P7342 P7364	1968	ACP	12	12	725	35	Diam/in/LF	$304,419	$426,187
				P7360 P7362 P7364	1968	Mortar Lined Steel Cylinder	18	18	2,249	35	Diam/in/LF	$1,416,870	$1,983,618
		Totals							**2,974**			**$1,721,289**	**$2,409,805**

Table 1-6 (Continued)
Capital Improvement Program

Year of Implementation	Project ID	Location	Justification	Pipe ID	Year of Construction	Material	Existing Size (in)	Ult. Size (in)	Length (ft)	Unit Cost ($)		Construction Cost ($)	Total Cost ($)
2020	9-1	Leisure World Well Pump and 250 HP Motor Replacement	Asset Maintenance	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	300,000	Each	$300,000	$420,000
2021	10-1	Aged Water Line Replacement, Outside Old Town	Age/ Condition (CIP)	P4902	1972	CIP	10	10	1,137	35	Diam/in/LF	$398,006	$557,208
				P8090	1968	CIP	10	10	76	35	Diam/in/LF	$26,600	$37,240
		Totals							**1,213**			**$424,606**	**$594,448**
Annual	Annual	Old Town Water Line Replacement - Phase 2 Annual Condition Replacements	Age/ Condition (CIP)	Varies	Varies		4	8	422	50	Diam/in/LF	$168,650	$236,110
							6	8	11,821	50	Diam/in/LF	$4,728,583	$6,620,016
							8	8	9,425	50	Diam/in/LF	$3,769,826	$5,277,757
							12	12	3,127	50	Diam/in/LF	$1,876,233	$2,626,726
		Totals							**24,795**			**$10,543,292**	**$14,760,609**
								Grand Total	**45,842**			**$24,864,778**	**$33,530,689**


Legend
WOCWB Connection
Emergency Connection
Pump Stations and Wells
Reservoir
City Pipe
CIP Project Locations
Annual Condition Improvements
City Limits
Community of Rossmoor (unincorporated)
City of Los Alamitos
City of Garden Grove
City of Westminster
City of Huntington Beach
City of Long Beach
Pacific Ocean
Golden State Water Company Emergency Connection
Lampson Avenue Well
Project 1-1
Project 1-2
Project 1-3
Bolsa Chica Well
Project 4-3
Project 4-2
Projects 7-1 & 9-1
Leisure World Well
Project 2-2
Beverly Manor Well, Reservoir, and Booster Pump Station
Project 5-1
Project 8-1
Westminster Emergency Connection
WOCWB Connection
Project 6-1
Long Beach Emergency Connection
Navy Reservoir and Booster Pump Station
Project 10-1
Project 8-2
Project 1-4 & 2-1
Project 7-2
Project 3-1
Project 10-1
Huntington Beach Emergency Connection
Project 4-1
Huntington Beach Emergency Connection
WESTMINSTER BLVD
GARDEN GROVE BLVD
SEAL BEACH BLVD
BOLSA CHICA RD
BOLSA CHICA ST
SPRINGDALE ST
EDINGER AV
PACIFIC COAST HWY
N
Feet
0 1,250 2,500 5,000
1" = 2,500'
CITY OF SEAL BEACH
WATER MASTER PLAN UPDATE
PROJECT NO: 0801070.00
DATE: July 2012
Capital Improvement Project Locations
Figure 1-1

SECTION 2

INTRODUCTION

2-1 Purpose

This section provides an overview and outline for the City of Seal Beach's (City) Water Master Plan Update. A brief background description, objectives and scope of work, acknowledgments, and a list of abbreviations used throughout the report are provided.

2-2 History and Background

The City of Seal Beach was incorporated in 1915 and has been in operation under its own charter since 1964. It covers an area of 11.2 square miles along the Pacific coast in the northwest corner of Orange County. The City's total population was 24,168 in 2010 according to Census information. The California State Department of Finance estimated the City's population to be 24,215 in 2011.

Originally called Bay City, Seal Beach was developed in the early 1900's as a resort destination for residents of the Los Angeles area. Its early growth was accelerated by the construction of the Pacific Electric Railway Trolley, which reached the City in 1906. The railway allowed visitors to reach the City more easily and in greater numbers to enjoy the many hotels, bathhouses and dance halls which were constructed for their recreation. Oil was discovered in the City in 1926, and the oil boom that followed resulted in the development of Seal Beach into the residential community it is today.

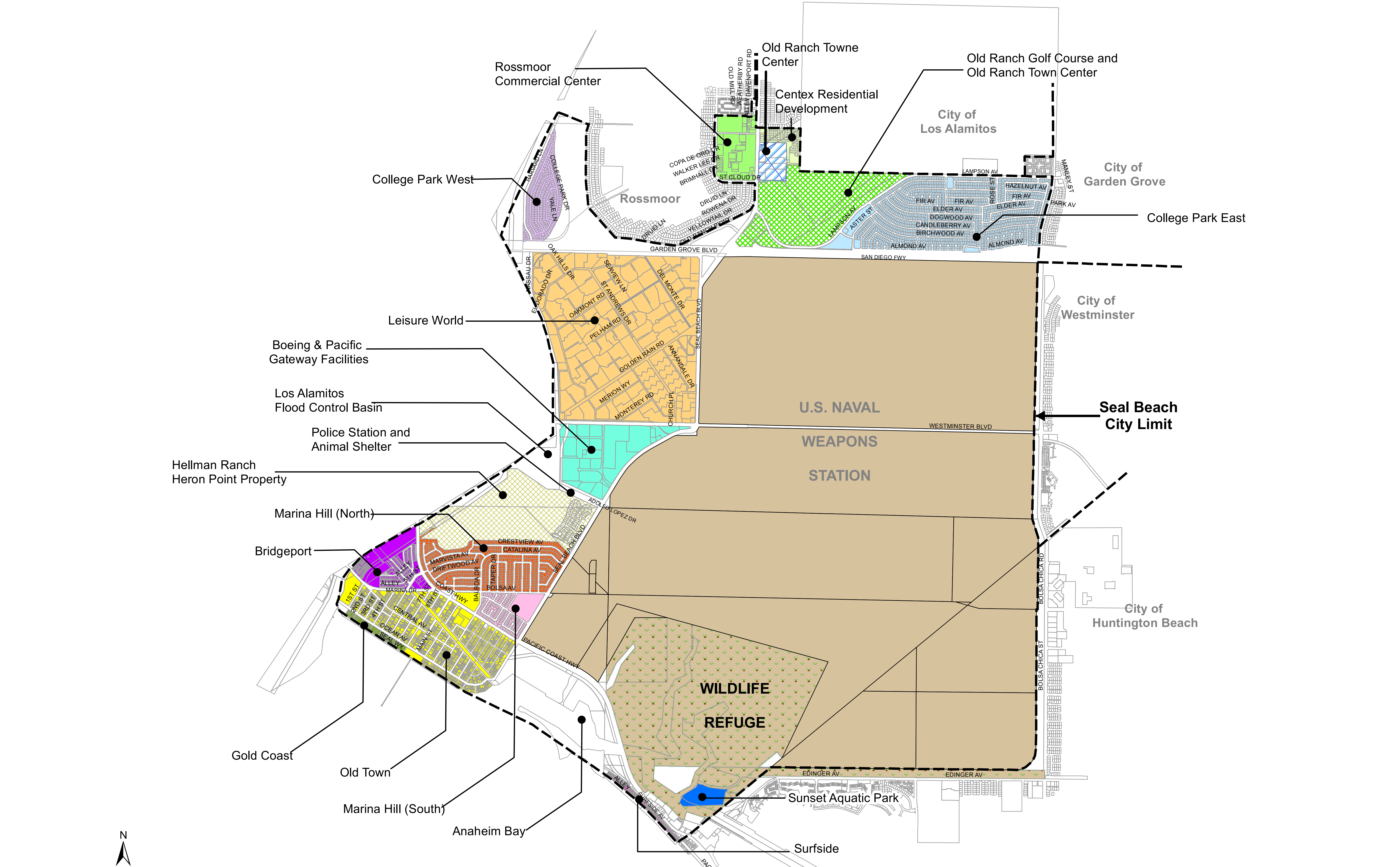
The City is subdivided into several distinct communities as shown on Figure 2-1, and described below.

- **Old Town,** the area south of Electric Avenue and Marina Drive, between 1st Street and Seal Beach Boulevard, was developed in the 1920's and is the oldest area within the City's corporate limits. High density residential and commercial land uses are prevalent in this area. The Gold Coast District is located directly on the beach and consists of large single-family residential lots. The City's mile long beach in Old Town is used for surfing and swimming. The Seal Beach Pier, located at the end of Main Street, provides fishing facilities and a restaurant.

- **Bridgeport** is the area located west of Pacific Coast Highway and north of Marina Drive. It was primarily developed in the 1960's and consists of medium density and high density residential land uses such as Oakwood Apartments and Seal Beach Mobile Home Park.

- **Marina Hill** was developed in the 1950's and consists of single-family homes. This area is located north of Pacific Coast Highway, adjacent to the southerly edge of Gum Grove Nature Park.

- **Surfside**, a colony, which was incorporated in the 1930's, became a part of Seal Beach in 1969. The area consists of single-family homes located on the south side of Anaheim Bay. Although a gated community, pedestrian and bicycle access to the beach is available. Surfside is a popular location for surfing and swimming.



PROJECT NO: 0801070.00

DATE: July 2012

CITY OF SEAL BEACH
WATER MASTER PLAN

Planning Communities

Figure 2-1

- **College Park East and College Park West** were both developed in the late 1960's. They are single-family residential communities located north of the San Diego Freeway.

- **The Rossmoor Commercial Center and the Old Ranch Towne Center** are located along Seal Beach Boulevard, at the northern limits of the City boundary. These centers include large anchor stores, as well as smaller community retail and service-use businesses.

- **Centex Development** is located between Plymouth Drive and the City of Los Alamitos, east of Seal Beach Boulevard. This development was completed in 2002 and includes 78 single-family homes.

- **The Leisure World Retirement Community** is located between Westminster Boulevard and the San Diego Freeway, west of Seal Beach Boulevard. This gated community was built in 1961. Leisure World is about 1,200 acres in size and includes 6,482 cooperative apartments, 126 condominiums, and an approximate population of 9,000. Leisure World provides a secure, serene environment for seniors 55 and older. Medical, religious, commercial and recreational facilities are all provided within the community limits.

- **Boeing Facilities and Pacific Gateway** occupies 107 acres southwest of Seal Beach Boulevard and Westminster Boulevard. Currently, this area is occupied by the Boeing Campus, the Pacific Gateway Plaza, and the Pacific Gateway Business Center. The Boeing plant manufactures satellites and has laboratory and testing facilities to support Boeing's space program. Engineering and design operations are also conducted from this facility. The remaining area has been recently developed with a business park, a hotel, commercial, and light industrial uses.

- **Hellman Ranch/Heron Point** occupies a 231-acre parcel of land located west of Seal Beach Boulevard, just north of the Marina Hill Community. The area includes the Heron Point Homes residential community, which consists of 70 single-family residences, Gum Grove Nature Park, restored wetlands, public access, oil resource production, civic/public land use, saltwater marsh wetlands, and freshwater wetlands.

- **U.S. Naval Weapons Station** was established in 1944. Comprising the majority of the City, it covers 5,256 acres bounded by the San Diego Freeway to the north, Bolsa Chica Road to the east, Pacific Coast Highway to the south, and Seal Beach Boulevard to the west. It encompasses Anaheim Bay which consists of an outer harbor formed by jetties, an inner harbor dredged to accommodate oceangoing ships, and a wetland system of salt marshes and tidal channels. The Wildlife Refuge is also included in the U.S. Naval Weapons Station boundary.

- **The Seal Beach National Wildlife Refuge** was established in 1972 and preserves 920 acres of salt marsh and upland area within Anaheim Bay. The refuge is located within the boundaries of the U.S. Naval Weapons Station, and there is restricted access.

- **Sunset Aquatic Park** was annexed by the County in 1975 from the U.S. Navy. It encompasses 67 acres of Anaheim Bay. The marina provides multi vessel launch ramps, storage, shipyard, restroom and laundry facilities, and a park.

2-3 Past Studies

Seal Beach Urban Water Management Plan was adopted by the City on June 27, 2011. The report was completed by Malcolm Pirnie, Inc. and included a description of the existing system, water sources, water demand, water quality, recycled water, water conservation, and potential water resources. It also evaluated the City's compliance with the State's 20x2020 Water Conservation Plan and the reliability of the City's water supply during a severe water shortage due to natural disasters or other emergencies.

Seal Beach Water Master Plan was prepared by AKM Consulting Engineers in 2003. It analyzed the water supply sources, pumping system, and distribution system through a planning period that extended to the year 2013. The 2003 Water Master Plan included a Capital Improvement Program (CIP) totaling over $13.5M.

The City has completed many of the projects within the CIP, which include:

- Navy Reservoir repairs
- Portions of the telemetry/SCADA upgrades
- Navy Booster Pump Station upgrade
- Navy Reservoir corrosion protection
- Lampson Avenue Well (College Park East Well)
- Leisure World connection from Seal Beach Boulevard (North)
- Leisure World connection from Seal Beach Boulevard (South)
- Beverly Manor Booster Station upgrades (in design)

Since the study was completed, the Heron Point Homes and Pacific Gateway projects were completed, adding significant demand and system improvements. The Orange County Flood Control District (OCFCD) provided recent improvements to the Los Alamitos Stormwater Pump Station, which required the City to abandon a portion of their 18-inch water line that interfered with OCFCD's project. The improvements have been designed and recently constructed.

Water Conservation Ordinance was adopted in 2009. The ordinance includes the following regulations:

- Minimize leaks
- Prevent runoff
- Limit irrigation hours between 5:00 p.m. and 9:00 a.m.
- Limit irrigation duration
- Providing restaurant water service upon request only
- Recirculation of water for decorative water features
- No single pass cooling systems in connection with new water services
- Re-circulating water systems for car wash and laundry facilities
- Car washing limitations
- Phase 1, 2, and 3 water conservation measures during drought conditions

Orange County Water District (OCWD) prepared its annual 2009-2010 Engineer's Report on the Groundwater Conditions, Water Supply and Basin Utilization in the Orange County Water District. OCWD manages the local groundwater production within Orange County. The report includes information on the basin hydrology, groundwater levels, groundwater conditions, groundwater usage restrictions, and overdraft.

2010 Water Quality Report documents that the City's water supply meets the federal (U.S. Environmental Protection Agency) and state (California Department of Public Health) drinking water quality standards.

2-4 Objectives and Scope of Work

The objective of this master plan is to evaluate the City's water supply system with the most current information and provide a framework for undertaking the construction of new and replacement facilities in an efficient manner. The master plan will also provide the City with a necessary tool for maintaining the integrity of its water assets and complying with the Government Accounting Standard Board Statement 34 (GASB34) which requires that agencies have an asset management system in place. Agencies must establish the condition in which they will maintain their assets, assess the condition of their infrastructure, estimate the useful lives and replacement costs, and determine the cost to maintain the desired condition of the infrastructure.

As a planning document, it is general in nature and is predicated upon the best information available at this time. The primary sources of information used during the course of this study are:

- GIS Information (Parcels, Land Use, Zoning/ Street Centerline)
- As-built drawings (all pump stations, reservoirs, wells, pressure reducing valves, pipes, turnouts, and interconnections)
- Final Report Seal Beach Urban Water Management Plan, dated June 2011
- MWDOC 2010 Urban Water Management Plan dated June 2011
- The Metropolitan Water District of Southern California Integrated Water Resources Plan 2010 Update
- Seal Beach Water Master Plan, dated June 2003
- 2009 Seal Beach Water Conservation Ordinance
- OCWD 2009-2010 Engineer's Report on the Groundwater Conditions, Water Supply and Basin Utilization in the Orange County Water District
- 2003 General Plan
- Aerial photographs (Google Earth Images)
- Water Production and Purchase History from July 2001 to June 2011
- Water meter records July 2009 to June 2010
- Facility visits
- City staff interviews
- Computer hydraulic model of water system in InfoWater (2012)
- United States Geological Survey (USGS) Maps

- Field pressure data collected via pressure data loggers (performed by AKM in conjunction with City staff)
- Fire flow and pressure data collected in field via hydrant tests (performed by AKM in conjunction with City staff)
- California Fire Code

The scope of work for the Water Master Plan Update consists of the following tasks:

1. Project management and communication
2. Collection and review of water system data
3. Site investigations
4. City staff interviews
5. Evaluation of existing potable water demands
6. Assessment of water quality issues
7. Evaluation of Regulatory Permits
8. System modeling and evaluation – model geometry, diurnal curves, demands, model calibration, interview City staff, fire hydrant flow testing
9. Hydraulic analysis – criteria, system hydraulic analyses, additional analyses
10. Recommended improvements
11. Capital Improvement Program
12. Water Master Plan Update document

2-5 Organization of Water Master Plan Update Report

This Water Master Plan Update report presents the methodology, analyses, findings, and recommendations of a comprehensive study of the City of Seal Beach's potable water system. A brief outline of the report follows:

- **Section 1: Executive Summary** provides a summary of the Water Master Plan Update report.
- **Section 2: Introduction** provides an overview and outline for the Water Master Plan Update report.
- **Section 3: Study Area** describes the physical features, current and future land use characteristics and population of the study area.
- **Section 4: Water Use** describes the existing and projected potable water demands within the service area
- **Section 5: Water Supply** describes the sources of potable water, including groundwater from the Main Orange County Groundwater Basin and imported water from Metropolitan Water District of Southern California (MWD) through the West Orange County Water Board (WOCWB).
- **Section 6: Existing Facilities** describes the facilities that provide water service to the service area.

- **Section 7: Service Criteria** discusses the standards and procedures utilized in estimating the water demands, assessing the system, and selecting the recommended improvements.
- **Section 8: Hydraulic Model** describes the development of the City's hydraulic model and model calibration.
- **Section 9: System Analysis** describes the hydraulic analysis of the system under average day, maximum day, peak hour, and maximum day plus fire flow conditions; condition assessment of the system; and the recommended improvements for eliminating the identified deficiencies.
- **Section 10: Capital Improvement Program** presents a prioritized capital improvement program for the recommended projects.

2-6 Acknowledgments

AKM Consulting Engineers would like to express their sincere appreciation to the following individuals for their valuable assistance and support throughout the preparation of this study:

Sean Crumby, Assistant City Manager / Director of Public Works

Michael Ho, City Engineer

David Spitz, Associate Engineer

Alan Bramlett, Chief Water Operator

Jeff Watson, Maintenance Services Manager

Kathy Dixon, Utility Billing

2-7 Abbreviations

To conserve space and improve readability, abbreviations have been used in this report. Each term abbreviated has been spelled out in the text the first time it is used. Subsequent usage of the term is usually by its abbreviation. The abbreviations utilized in this report are contained in Table 2-1.

Table 2-1
Abbreviations

Abbreviation	Explanation
ac, AC	Acre
ACP	Asbestos cement pipe
AF	Acre-foot or acre feet
AFY	Acre feet per year
AL	Action Level
amsl	Above mean sea level
AWPF	Advanced Water Purification Facility
AWWA	American Water Works Association
BMP	Best Management Practices
BPP	Basin Production Percentage
CDPH	California Department of Public Health
cfs	Cubic feet per second

Abbreviation	Explanation
cip	Cast iron pipe
CIP	Capital Improvement Program
City	City of Seal Beach
CUWCC	California Urban Water Conservation Council
D/DBPR	Disinfectants/Disinfection By-Products Rule
DIP	Ductile iron pipe
DPH	Department of Public Health
du, DU	Dwelling unit
DWR	State of California, Department of Water Resources
DW	Domestic water
el	Elevation
ENR	Engineering News Record
EPA	United States Environmental Protection Agency
ESWTR	Enhanced Surface Water Treatment Rule
F	Fahrenheit
FAF	Floor Area Factor
FAR	Floor Area Ratio
FCV	Flow control valve
fps	Feet per second
ft	Feet
GIS	Geographic information system
gpcd	Gallons per capita per day
gpd	Gallons per day
gpm	Gallons per minute
HGE	Hydraulic grade elevation
hp	Horsepower
LF	Lineal feet
mg	Million gallons
mgd	Million gallons per day
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MOU	Memorandum of Understanding
MWD	Metropolitan Water District of Southern California
MWDOC	Municipal Water District of Orange County
OCFA	Orange County Fire Authority
OCFCD	Orange County Flood Control District
OCWD	Orange County Water District
O&M	Operations and Maintenance
OSHA	Occupational Safety & Health Administration
PCC	Pre-cast concrete
PHG	Public Health Goal
PRS	Pressure regulating station
PRV	Pressure reducing valve
psi	Pounds per square inch
PVC	Polyvinyl chloride

Abbreviation	Explanation
RPM	Revolutions per minute
SCADA	Supervisory control and data acquisition
SDWA	Safe Drinking Water Act
SF	Square feet
stl	Steel
TDH	Total dynamic head
TDS	Total dissolved solids
THAAS	Total halo acetic acids
TOC	Total organic carbons
TTHMS	Total trihalomethanes
μg/l.	Micrograms per Liter
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
WWTP	Wastewater Treatment Plant
WOCWB	West Orange County Water Board
VFD	Variable Frequency Drive

SECTION 3

STUDY AREA

3-1 Purpose

This section describes the study area of the Water Master Plan Update, and it discusses the land uses and population estimates within the study area that are utilized in estimating the water demands.

3-2 Location

The City of Seal Beach is primarily a residential community located along the California coastline in western Orange County. It is bordered to the north by the City of Los Alamitos and the unincorporated Rossmoor community; to the east by the Cities of Garden Grove, Westminster, and Huntington Beach; to the south by the Pacific Ocean and City of Huntington Beach; and to the west by the City of Long Beach (Los Angeles County). The location of the study area is shown on Figure 3-1.

The City's territory is crossed by several major Southern California highways, providing access into the City from all directions. The San Diego Freeway (I-405) runs between the College Park East community and the U.S. Naval Weapons Station on the east, and between the College Park West community and Rossmoor on the north. The Garden Grove Freeway (SR-22) divides the College Park West community from Leisure World. The San Gabriel River Freeway (I-605) ends in the City, and it runs between the College Park West community and Rossmoor. Pacific Coast Highway runs through the southern portion of the City, north of the Old Town community and east of the Bridgeport community. Other major roads within the City include Seal Beach Boulevard, Lampson Avenue, Westminster Boulevard, Bolsa Avenue, and Main Street.

3-3 Topographical Description

The majority of the City is located within an alluvial plain that extends southwards from the convergence of Coyote Creek and the San Gabriel River. The two channels drain from the northeast and the north respectively and the combined flow reaches the Pacific Ocean at the Alamitos Gap.

Landing Hill, located within Seal Beach, Alamitos Heights in Long Beach, and Bolsa Chica Mesa in Huntington Beach consist of uplifted blocks within and near the Newport-Inglewood fault zone, and are the major topographic features within and near the City (City of Seal Beach General Plan, Safety Element, August, 1997). As illustrated on Figure 3-2, the Newport-Inglewood Fault runs through the City, and is parallel to the coastline.

The City is relatively flat, except in the Marina Hill Community, where the highest ground elevation is approximately 57 feet above mean sea level (amsl) along Crestview Avenue, between Crest Drive and Bayside Drive. The lowest ground elevation is sea level along the beach frontage.

3-4 Geology

The 1986 Orange County Hydrology Manual classifies the soils into four (4) hydrologic soil groups: “A”, “B”, “C”, and “D”. The soil classifications within the City boundaries are illustrated on Figure 3-3.

N

Not to scale

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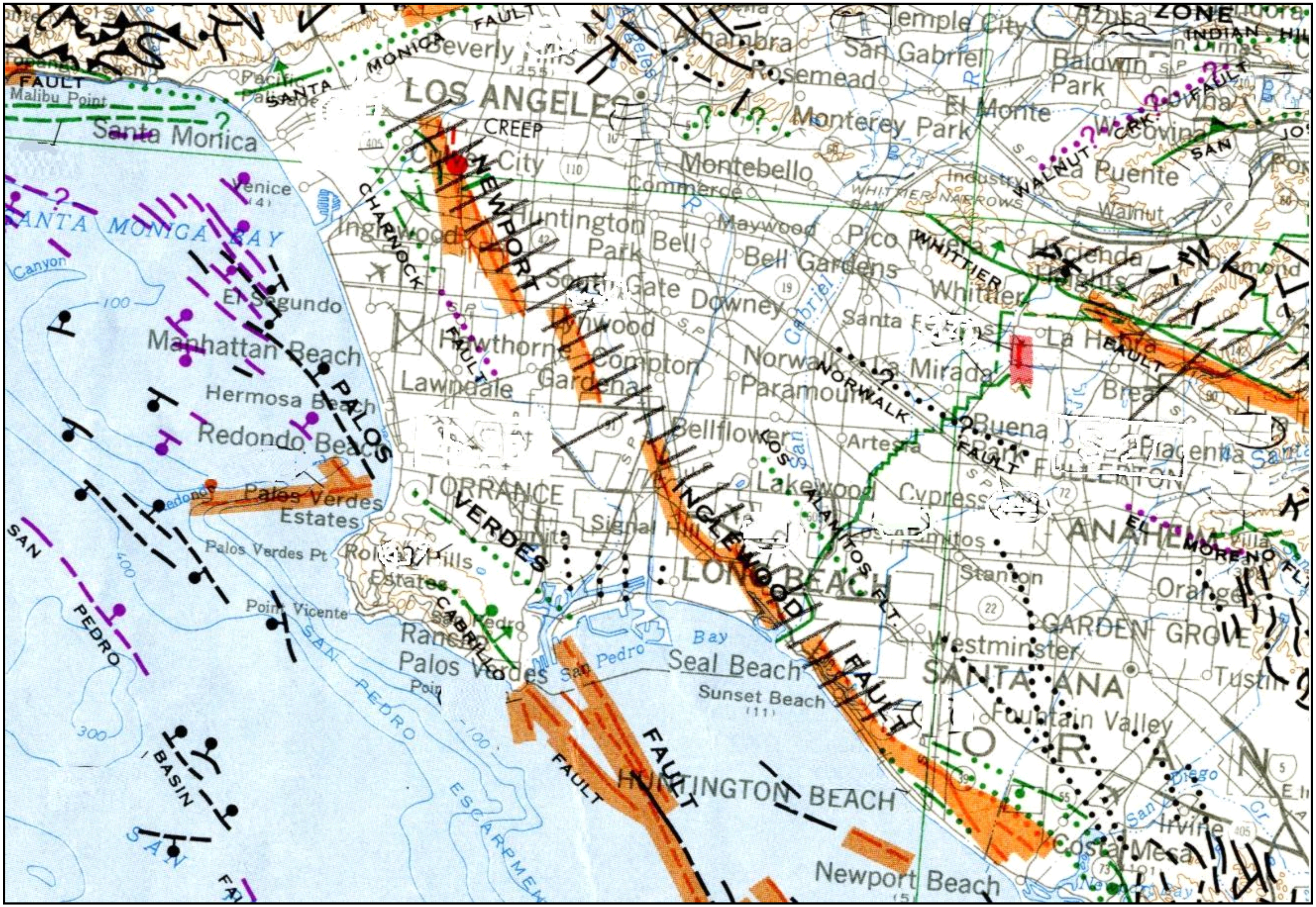
CITY OF SEAL BEACH
WATER MASTER PLAN UPDATE

Location Map

Figure 3-1



Reference: Jennings, 1994, Fault Activity Map of California and Adjacent Areas

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Fault Map

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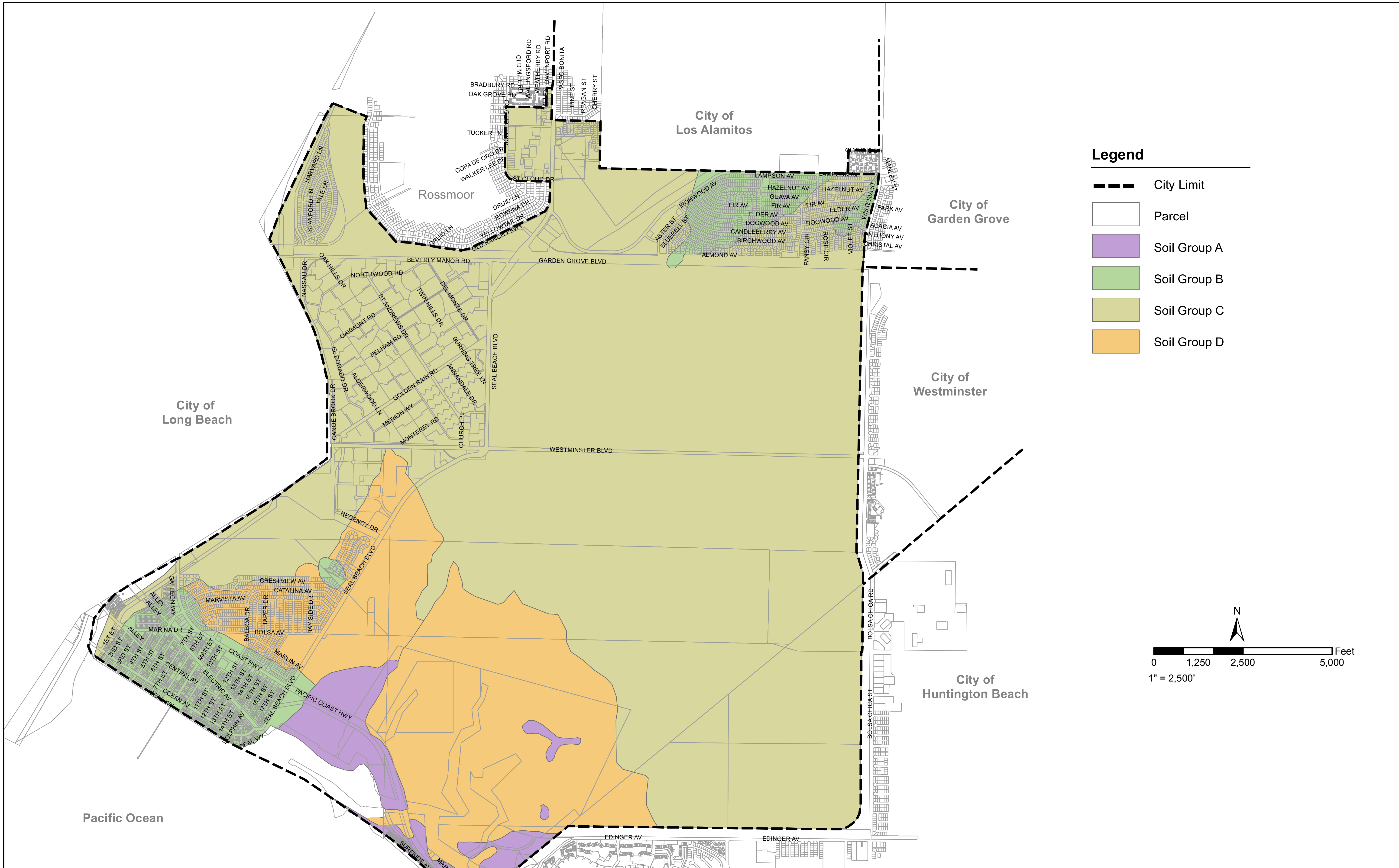
Figure 3-2



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Hydrological Soil Groups

Figure 3-3

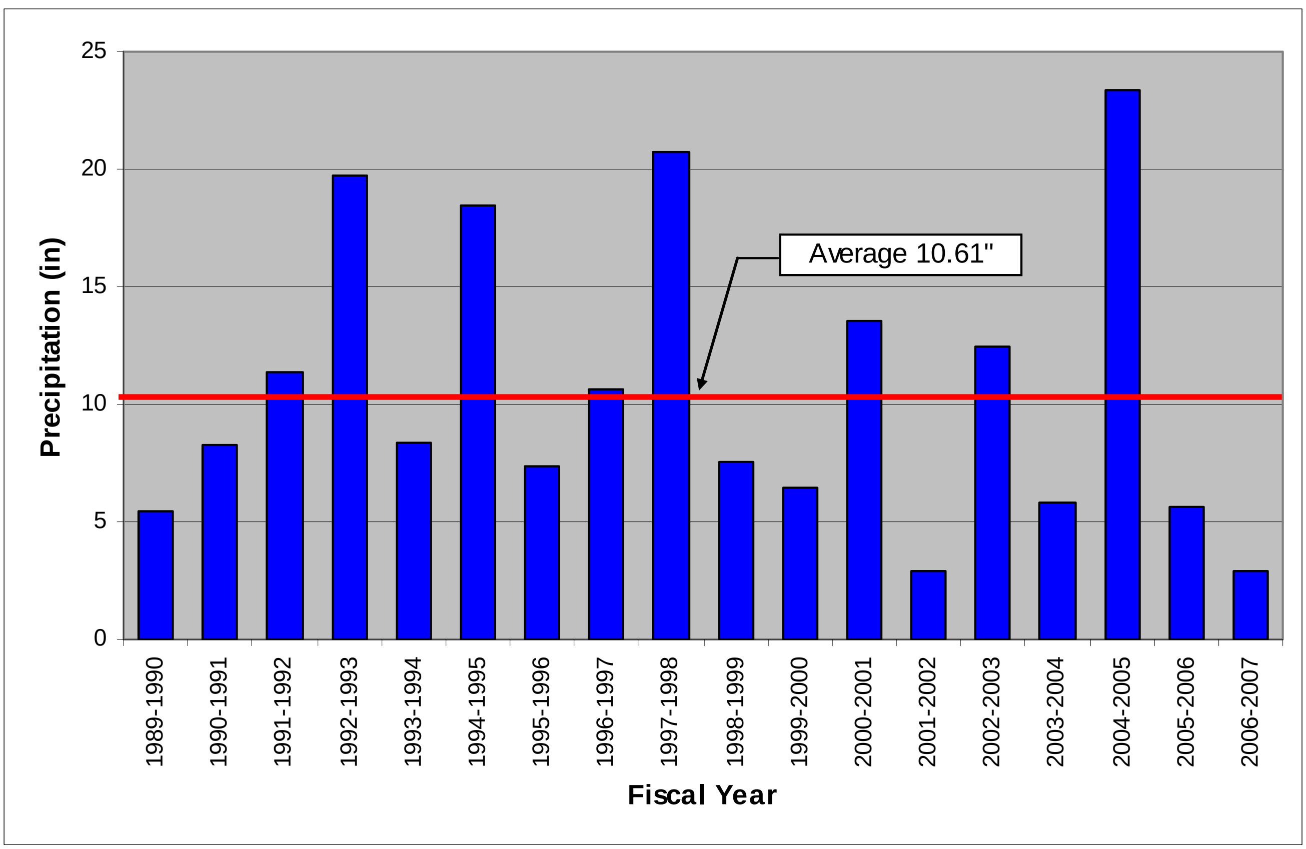
Several soil types underlie the study area, with the predominant soil type being silty-loam soils (Soil Group C), which impede downward movement of water. Impervious clay soils (Soil Group D) can be found south of Westminster Boulevard, near Marina Hill, in the southwest portion of the U.S. Naval Weapons Station, and in the Wildlife Refuge.

Well drained sandy- loam soils (Soil Group B) are mainly found in the Old Town, Bridgeport, and College Park East communities. Small patches of well-drained sand or gravel soils (Soil Group A) are located along Pacific Coast Highway, east of Seal Beach Boulevard.

3-5 Climate

The study area has a Mediterranean-like climate, enjoying plenty of sunshine throughout the year. The period of April through November is warm to hot and dry with high temperatures of 82 - 84°F and lows of 53 - 65°F. The coolest months are typically December and January, with an average minimum temperature of 46°F. Heaviest precipitation generally occurs between October and March. The seasonal rainfall, measured at the Orange County Flood Control District's (OCFCD) Los Alamitos Stormwater Pump Station (Orange County Public Works Station Number 170) is shown on Figure 3-4. Due to construction at the OCFCD facilities, there is no rainfall data between 2007 and the present. The average rainfall between the 1989/1999 fiscal year and the 2006/20007 fiscal year is 10.61 inches.

Figure 3-4
Seasonal Rainfall 1989-2007



3-6 Land Use

The land use information utilized in the preparation of the Water Master Plan Update is primarily based upon the City's General Plan and Land Use Element, and aerial photography. Excluding the U.S. Naval Weapons Station, the City of Seal Beach is primarily a residential community with supporting commercial as well as light industrial and institutional land uses. The City is mostly developed with a mix of residential, commercial, industrial, and public land uses. Land use designations in the service area are listed in Table 3-1 and depicted on Figure 3-5.

Table 3-1
Existing Study Area Land Uses

Designation	Minimum Lot Area (sq. ft.)	Building Intensity (DU/Acre)*	Proposed/ Developed (acres)
Residential			
Low	5,000	9 DU/Acre	413
Medium	2,500	17 DU/Acre	496
High	1,350	32 DU/Acre	129
Commercial			
Professional Office	7,000	0.50 - 0.60 FAR	24
Service	7,000	0.60 - 0.75 FAR	42
General	7,000	0.60 -0.80 FAR	103
Industrial			
Light	10,000	0.70 FAR	103
Oil Extraction			67
School/Community Facility			85
Military			4,601
Open Space			
Open Space			141
Golf Course / Park			247
Park			
Beach			81
Streets and Right of Way			602
Total			**7,135**

* The development intensity standard indicates the theoretical "maximum" allowable development permitted for specific land use designation (DU = dwelling units; FAR = floor area ratio). All proposed development must also adhere to the City's zoning code and/or regulations established in a specific plan.

According to the 2011 California Department of Finance Housing Estimates, the total number of housing units within the City is 14,558 with a 10.59 percent vacancy rate.

Legend

- Residential Low Density
- Residential Medium Density
- Residential High Density
- Commercial - Professional Office
- Commercial - Service
- Commercial - General
- Industrial - Light
- Industrial - Oil Extraction
- Open Space
- Park/ Golf
- School/Community Facility
- Military
- Beach

Feet
0 1,250 2,500 5,000
1" = 2,500'

CITY OF SEAL BEACH
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Land Use

Figure 3-5

Residential Land Uses

Per the City's Land Use Element, the low density residential uses provide for single-family residences with densities up to 7 dwelling units per acre and the lots that shall not be less than 5,000 square feet per dwelling unit. Low density residential land use is located in Marina Hill, Heron Point, College Park West, College Park East, Centex Development, and along the Gold Coast.

Medium density residential uses allow for dwelling units such as single-family housing in clusters, townhouses, and two-family housing on single lots. This land use provides densities which do not exceed 17 dwelling units per acre, and the minimum lot area is 2,500 square feet. Medium density land uses are located in the Bridgeport, Leisure World, Old Town, and College Park East communities.

High density residential uses include the Oakwood Apartments, the Seal Beach Trailer Park, the apartment complexes adjacent to the Rossmoor Commercial Center and the complexes located throughout the Old Town community. High density residential uses provide for minimum lot areas of 1,350 square feet and densities that do not exceed 32 dwelling units per acre. The apartment complexes that are adjacent to the Rossmoor Commercial Center and within the City boundary are currently served by the Golden State Water Company.

Commercial Uses

In general, commercial land uses are scattered throughout the City, with access along Seal Beach Boulevard, Pacific Coast Highway, Marina Drive, Main Street, and Lampson Avenue.

Commercial land use consists of professional offices, service, and general. Professional offices include all types of offices including medical, engineering, real estate, etc. Service Commercial land uses include businesses that provide a variety of consumer goods and personal services. General Commercial land uses consist of businesses that are highway oriented, such as automobile service stations, motels, and restaurants.

Currently the Rossmoor Commercial Center is served by the Golden State Water Company.

Industrial Uses

Light industrial land uses consist of the Boeing Integrated Defense Systems Headquarters facility. The Boeing plant manufactures satellites and has laboratory and testing facilities to support Boeing's space program. Engineering and design operations are also conducted from this facility. Recently, a hotel, business park, commercial and light industrial uses have been developed on portions of this property.

In addition to the light industrial land use, approximately 50 acres on the Hellman Ranch Property has been granted for oil extraction by the California Coastal Commission.

Schools and Public Facilities

Public facility land use includes all government properties, such as public schools, playgrounds, Civic Center, City Yard, and the Pacific Electric right of way.

Military

The Seal Beach Naval Weapons Station comprises the majority of the City, covering 5,256 acres bounded by the San Diego Freeway to the north, Bolsa Chica Road to the east, Pacific Coast Highway to the South, and

Seal Beach Boulevard to the west. Anaheim Bay and the Wildlife Refuge are encompassed in the U.S. Naval Weapons Station boundary.

Open Space

Open space land use includes the Hellman Ranch Property, which has been designated as wetland restoration by the Hellman Ranch Specific Plan.

The current open space area in the Old Town Community near Marina Drive and First Street is planned to be developed into a residential community and park.

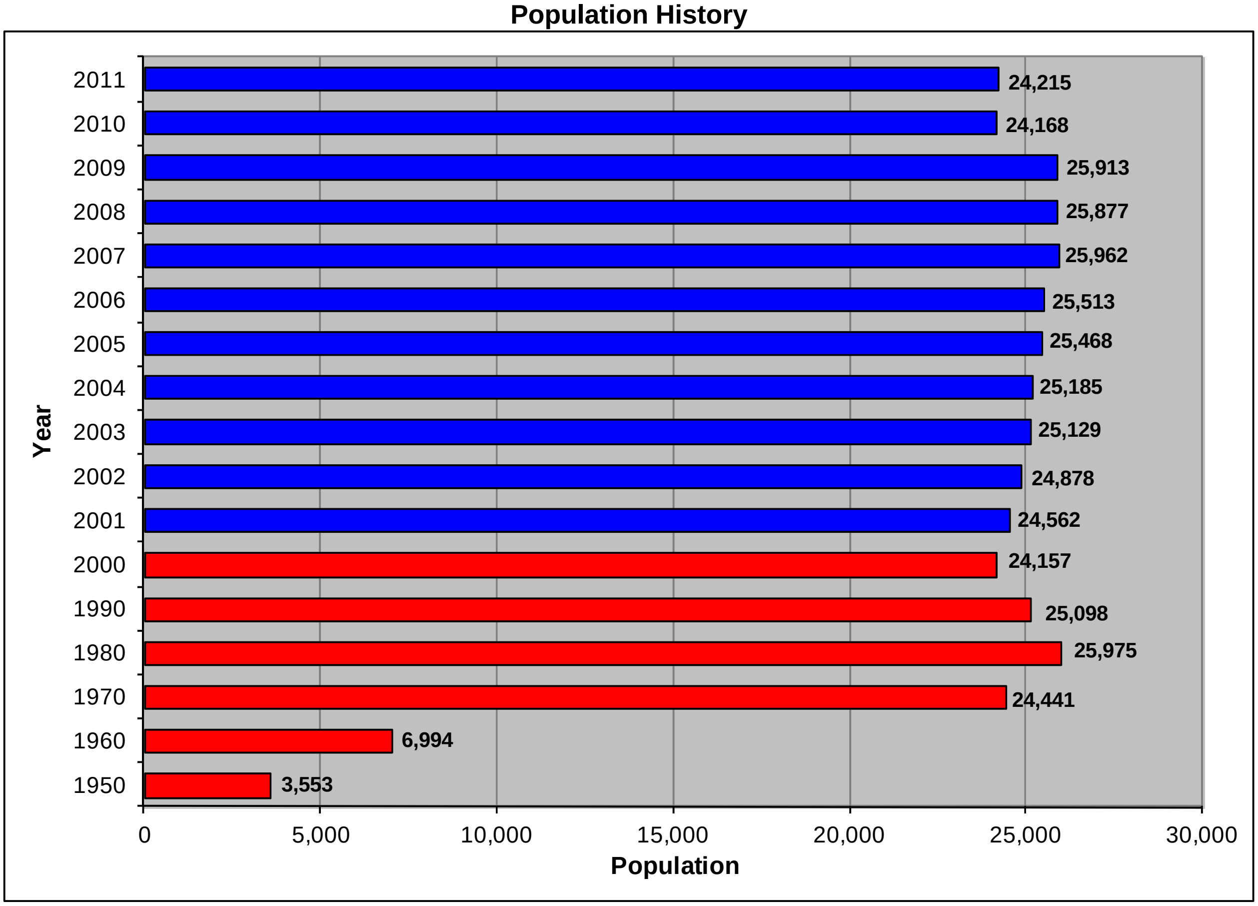
The Open Space land use also includes the Old Ranch Golf Course, public parks, and the beach front.

3-7 Population

Since its incorporation in 1915, the City of Seal Beach has grown from a population of 250 to 24,215 in 2011 (California Department of Finance, Demographic Research Unit). The City's population history is illustrated on Figure 3-6.

With the total number of housing units at approximately 14,558 and a 10.59 percent vacancy rate, the population per household is estimated to be 1.86 (California Department of Finance, Demographic Research Unit).

Figure 3-6
Population History



SECTION 4

WATER USE

4-1 Historic Water Use

The City purchases imported water from Metropolitan Water District of Southern California (MWD) through Municipal Water District of Orange County (MWDOC) and the West Orange County Water Board (WOCWB). The imported water supplements the groundwater that the City obtains from the Orange County Groundwater Basin through its four wells.

The total annual water purchase and groundwater from July 2001 to June 2011 is shown in Table 4-1 and on Figure 4-1. Figure 4-2 illustrates the historic water production by month. Over the last ten fiscal years, the annual imported water purchase has averaged 1,249 acre feet per year (AFY) {1.11 million gallons per day (mgd); 774 gallons per minute (gpm); 1.72 cubic feet per second (cfs)}, and the annual groundwater production has averaged 2,756 AFY {2.46 mgd; 1,708 gpm; 3.81 cfs}. The City's groundwater right is determined by the Orange County Water District (OCWD), which establishes yearly Basin Production Percentages (BPP), defined as "*the ratio that all water to be produced from groundwater supplies within the district bears to all water to be produced by persons and operations within the district from supplemental sources as well as from groundwater within the district*". Per the 2009-2010 OCWD Engineer's Report, the BPP was set at 62.0 percent for the 2010-2011 fiscal year.

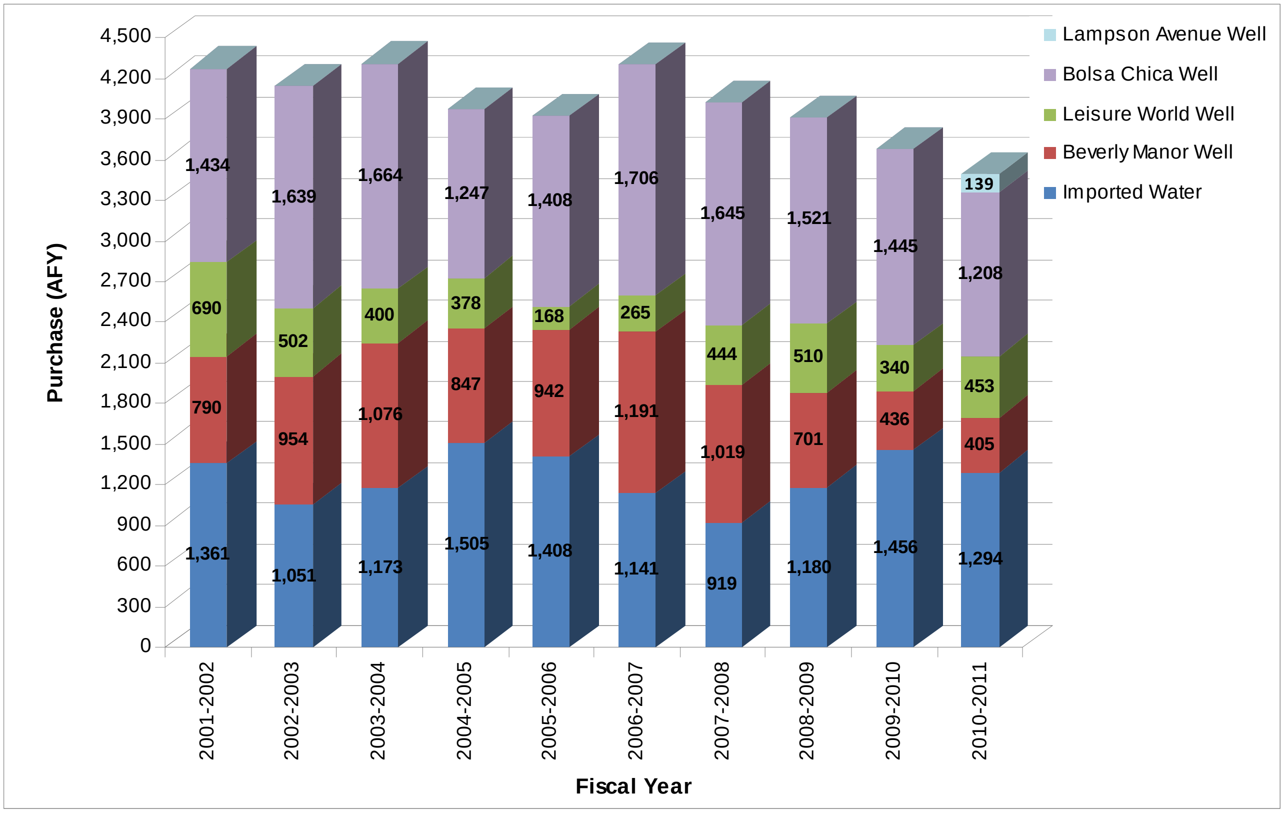
Since the 2006-2007 fiscal year, the City's total water use has declined from 4,303 AFY to 3,498 AFY. This reduction is primarily due to a conscientious water conservation effort by the City and its residents.

Table 4-1
Historical Imported Water Purchase and Groundwater Production (Annual)

	Imported Water			Groundwater											Total Water Use	
				Beverly Manor Well		Leisure World Well		Bolsa Chica Well		Lampson Avenue Well		Total				
Fiscal Year	(AFY)	(mgd)	(%)	(AFY)	(mgd)	(AFY)	(mgd)	(AFY)	(mgd)	(AFY)	(mgd)	(AFY)	(mgd)	(%)	(AFY)	(mgd)
2001-2002	1,361	1.21	32%	790	0.71	690	0.62	1,434	1.28	-	-	2,914	2.60	68%	4,275	3.82
2002-2003	1,051	0.94	25%	954	0.85	502	0.45	1,639	1.46	-	-	3,095	2.76	75%	4,146	3.70
2003-2004	1,173	1.05	27%	1,076	0.96	400	0.36	1,664	1.49	-	-	3,140	2.80	73%	4,313	3.85
2004-2005	1,505	1.34	38%	847	0.76	378	0.34	1,247	1.11	-	-	2,472	2.21	62%	3,978	3.55
2005-2006	1,408	1.26	36%	942	0.84	168	0.15	1,408	1.26	-	-	2,518	2.25	64%	3,927	3.51
2006-2007	1,141	1.02	27%	1,191	1.06	265	0.24	1,706	1.52	-	-	3,162	2.82	73%	4,303	3.84
2007-2008	919	0.82	23%	1,019	0.91	444	0.40	1,645	1.47	-	-	3,107	2.77	77%	4,026	3.59
2008-2009	1,180	1.05	30%	701	0.63	510	0.45	1,521	1.36	-	-	2,731	2.44	70%	3,911	3.49
2009-2010	1,456	1.30	40%	436	0.39	340	0.30	1,445	1.29	-	-	2,221	1.98	60%	3,678	3.28
2010-2011	1,294	1.16	37%	405	0.36	453	0.40	1,208	1.08	139	0.12	2,203	1.97	63%	3,498	3.12
Average	**1,249**	**1.11**	**31%**	**836**	**0.75**	**415**	**0.37**	**1,492**	**1.33**	**139**	**0.12**	**2,756**	**2.46**	**69%**	**4,005**	**3.58**

**Water Data from Seal Beach Water Department*

Figure 4-1
Historical Imported Water Purchase and Groundwater Production



**Data from Seal Beach Water Department*

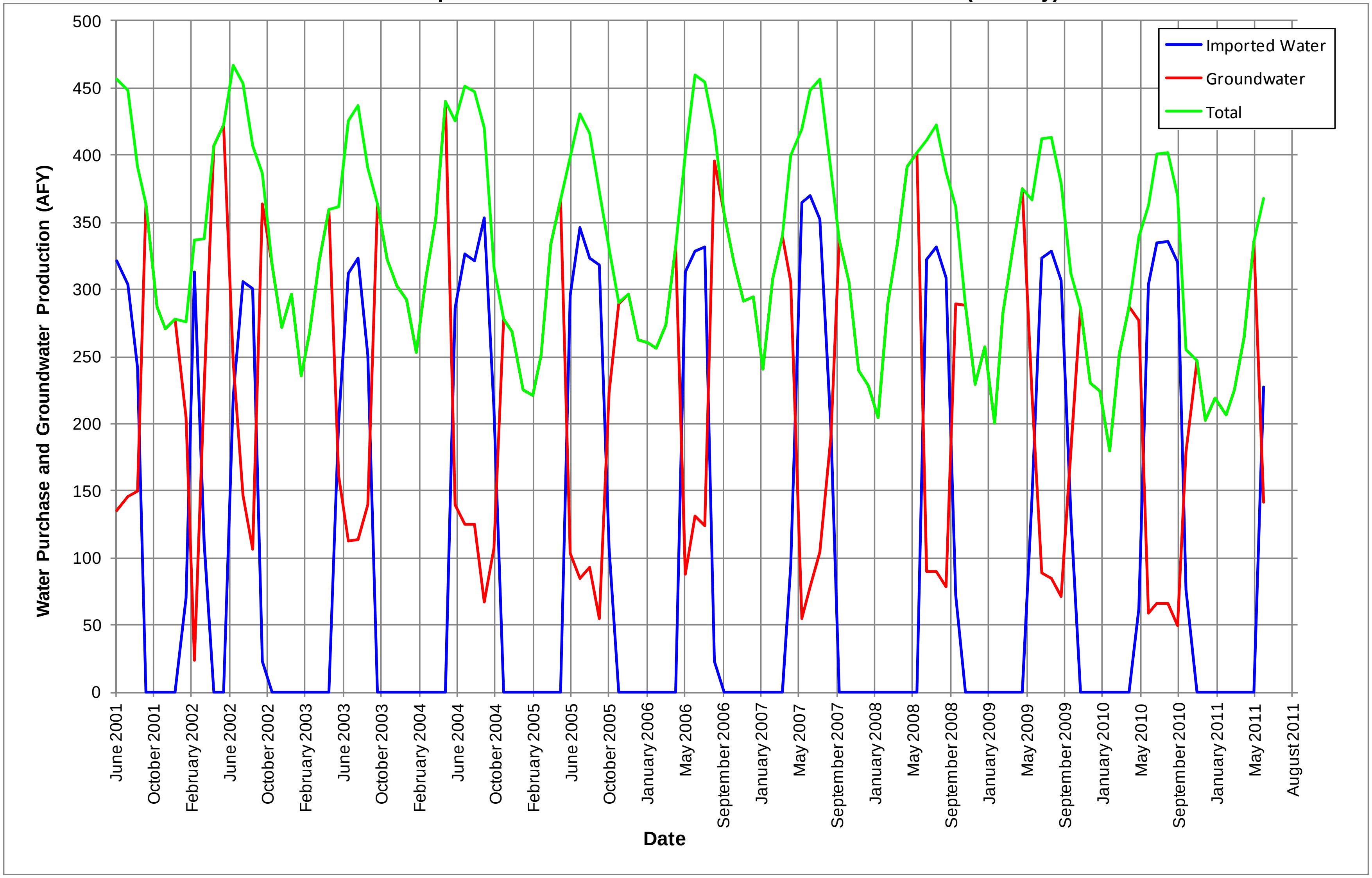
4-2 Water Consumption versus Water Purchase/Production

The City's consumption records from July 2009 to June 2010 were reviewed for the purposes of this master plan. The Citywide average consumption was estimated at 3,615 AFY {3.22 mgd, 2,240 gpm, 4.99 cfs}.

Unaccounted for water is the difference between the purchase/production and the sum of the individual customers' consumption. The City typically purchases and produces more water than the quantity measured by the customer meters. Unaccounted for water may be partly due to the differences in the accuracies of the large meters which measure purchase and production, and the thousands of small customer meters which measure sales. Water losses can also be due to unmeasured uses such as water main flushing and other maintenance related tasks and water leaks.

The water purchase and production records from July 2009 to June 2010 totaled 3,678 AFY {3.28 mgd, 2,278 gpm, 5.08 gpm}. During this study period, approximately 1.7 percent of the water supply was unaccounted for. This is well within the 10 percent or less industry standard for unaccounted for water.

Figure 4-2
Historical Imported Water Purchase and Groundwater Production (Monthly)



Water Data from Seal Beach Water Department

4-3 Water Demand Variations

Demand variations through a year are influenced by seasonal effects such as temperature, humidity, and precipitation. Due to its proximity to the Pacific Ocean, such variations are quite moderate for the City.

System demand variations throughout a day are influenced by the customer base and the daily lifestyles of the customers. In a service area such as the City's, the peak demands within a day are expected to occur in the morning hours between 6:00 am and 9:00 am, when customers wake to begin their daily routine. However, demand variation within the City's service area is heavily affected by the water use pattern in Leisure World, which has extensive irrigation between 12:00 a.m. and 5:00 a.m.

4-4 Monthly Demand Variations

Typical of most Southern California communities, the City's water consumption exhibits a distinct seasonal pattern. Peak and low monthly consumption occur during the dry summer months and wet winter months, respectively. Monthly demand totals for the 2001-2002 fiscal year to the 2010-2011 fiscal year are shown in Table 4-2. Peak demands typically occur in July and August. Low demands typically occur in February.

For this study, the monthly variations or demand factors are expressed as a ratio to the average demand, with the average demand being equal to one. The highest and lowest monthly demand factors shown in Table 4-2 are 1.36 in August 2007 and 0.59 in February 2010, respectively. The overall average monthly demand factors range from 0.68 in February to 1.31 in August. A graph of the monthly demand factors (monthly demand/average monthly demand) by water year is illustrated on Figure 4-3.

Figure 4-3
Monthly Demand Factors

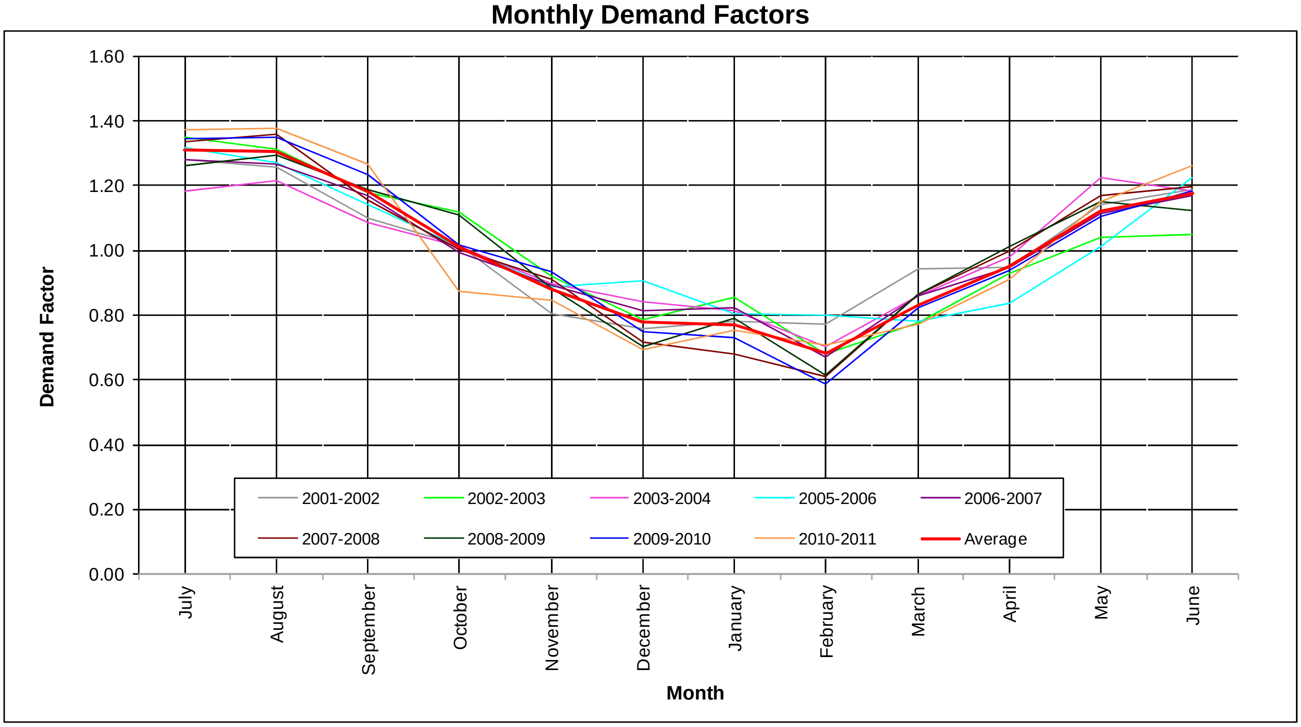


Table 4-2
Monthly Water Demands (AF) and Demand Factors

Month	2001-2002		2002-2003		2003-2004		2004-2005		2005-2006	
	(AF)	Factor	(AF)	Factor	(AF)	Factor	(AF)		(AF)	Factor
July	456.12	1.28	466.74	1.35	425.39	1.18	450.96	1.36	430.85	1.32
August	448.61	1.26	453.13	1.31	436.82	1.22	446.80	1.35	416.02	1.27
September	391.63	1.10	406.70	1.18	390.55	1.09	420.19	1.27	372.77	1.14
October	363.16	1.02	386.71	1.12	363.49	1.01	316.56	0.96	330.38	1.01
November	287.39	0.81	318.59	0.92	322.04	0.90	278.34	0.84	290.08	0.89
December	270.79	0.76	271.31	0.79	302.49	0.84	268.91	0.81	296.64	0.91
January	277.82	0.78	296.03	0.86	291.99	0.81	225.10	0.68	262.75	0.80
February	275.37	0.77	235.35	0.68	252.95	0.70	220.98	0.67	260.84	0.80
March	336.60	0.94	267.92	0.78	309.24	0.86	250.78	0.76	256.13	0.78
April	337.45	0.95	321.71	0.93	352.14	0.98	333.60	1.01	274.09	0.84
May	407.10	1.14	360.01	1.04	439.71	1.22	367.05	1.11	331.14	1.01
June	422.97	1.19	362.07	1.05	425.99	1.19	398.25	1.20	400.49	1.23
Average	**356.25**		**345.52**		**359.40**		**331.46**		**326.85**	

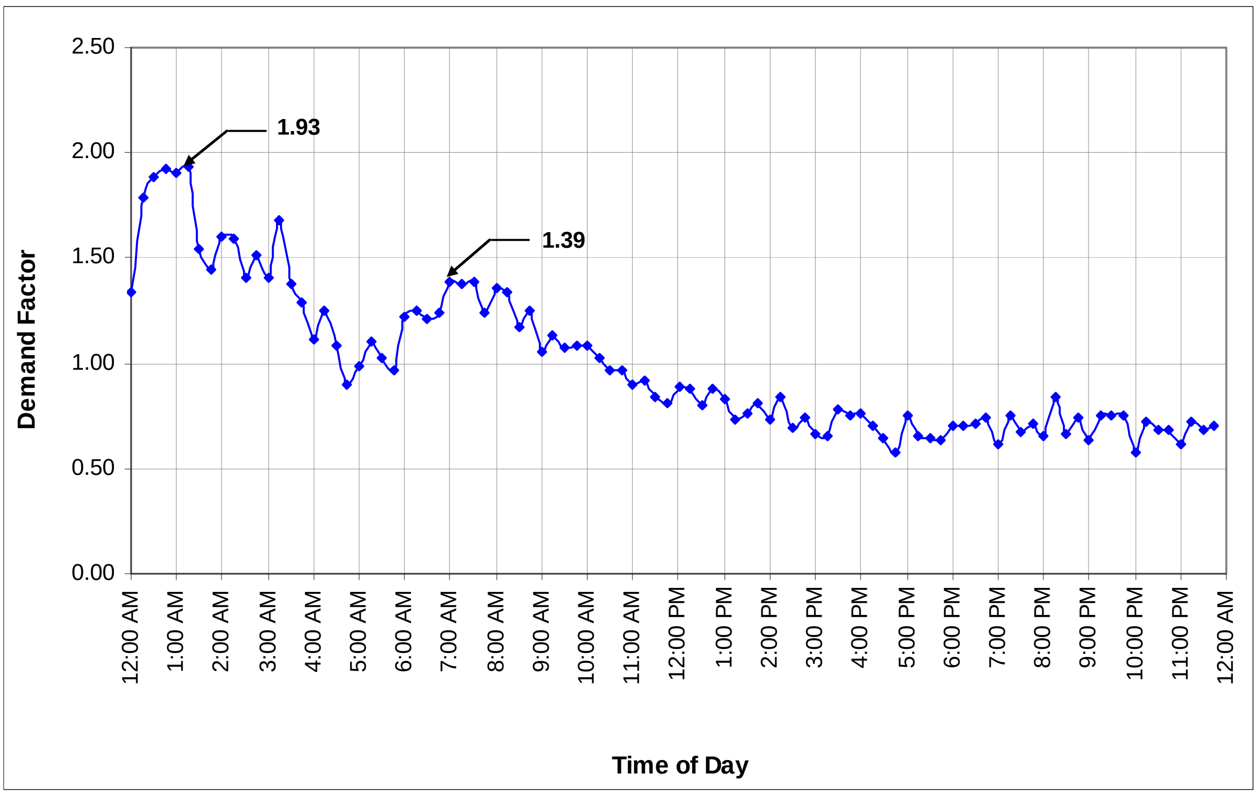
Month	2006-2007		2007-2008		2008-2009		2009-2010		2010-2011		Average Factor
	(AF)	Factor	(AF)	Factor	(AF)	Factor	(AF)	Factor	(AF)	Factor	
July	459.50	1.28	448.33	1.34	411.29	1.26	412.29	1.35	400.88	1.38	1.31
August	454.97	1.27	456.52	1.36	422.19	1.30	413.54	1.35	402.15	1.38	1.31
September	418.70	1.17	388.08	1.16	387.74	1.19	378.95	1.24	369.79	1.27	1.18
October	356.42	0.99	336.38	1.00	361.92	1.11	312.14	1.02	255.22	0.88	1.01
November	320.23	0.89	305.90	0.91	288.07	0.88	286.23	0.93	246.96	0.85	0.88
December	291.16	0.81	239.83	0.71	229.08	0.70	230.20	0.75	202.57	0.69	0.78
January	294.40	0.82	228.02	0.68	257.56	0.79	224.35	0.73	219.49	0.75	0.77
February	240.55	0.67	204.86	0.61	200.35	0.61	179.93	0.59	206.86	0.71	0.68
March	307.70	0.86	289.73	0.86	281.66	0.86	251.69	0.82	224.72	0.77	0.83
April	340.13	0.95	334.49	1.00	329.33	1.01	286.97	0.94	264.96	0.91	0.95
May	399.40	1.11	391.61	1.17	375.33	1.15	338.97	1.11	336.19	1.15	1.12
June	419.53	1.17	401.77	1.20	366.52	1.12	362.36	1.18	368.17	1.26	1.18
Average	**358.56**		**335.46**		**325.92**		**306.47**		**291.50**		

4-5 Hourly Demand Variations

Knowledge of accurate demand variations over a 24-hour period is essential for proper analysis of water systems. Demand variations during a day are represented by the development of a diurnal demand curve. The diurnal demand curves are employed in determining the adequacy of the sources of supply and the transmission/distribution facilities.

The City's water usage was analyzed with the use of information from the SCADA system between June 3, 2011 and June 6, 2011. Bolsa Chica Well and Lampson Avenue Well operational data and the Navy Reservoir levels were used to calculate the total system demand in 15-minute increments over a 24-hour period. The City-wide diurnal demand curve developed is shown on Figure 4-4.

Figure 4-4
Total System Diurnal Curve



The total system diurnal curve exhibits two peaks. The main peak factor is approximately 1.93 and occurs in the early morning around 1:15 a.m. This peak factor is attributed to high irrigation water usage within the Leisure World community, which provides the majority of the irrigation between 12:00 a.m. and 5:00 a.m. to minimize any inconvenience to the community residents. The second peak factor is approximately 1.39 and occurs around 7:00 a.m. which is typical for a primarily residential community.

SCADA data for Leisure World community flow meters confirm that there is a significant early morning peak demand caused by the irrigation system operations within Leisure World. The following two diurnal curves were developed and are shown on Figure 4-5 and in Table 4-3:

1. Leisure World community (includes heavy irrigation from 12 am to 5 am)

2. Remaining City areas including Bixby Ranch, Boeing, Bridgeport, College Park East, College Park West, Hellman Ranch, Marina Hill, Old Town, Sunset Aquatic Park, Rossmoor Center, Centex Development, and Surfside. It is assumed College Park West has a similar demand pattern to the other residential areas in the City, excluding Leisure World.

Currently, heavy water usage occurs in the Leisure World community for irrigation purposes between 12:00 a.m. and 5:00 a.m. The demands remain relatively constant throughout the remainder of the day between 6:00 a.m. and 12:00 a.m. The peak hour demand is approximately 3.84 times the daily average at about 12:45 a.m.

The demand pattern for the remainder of the City is quite typical of predominately residential service areas, with the peak demands occurring between 6:00 a.m. and 9:00 a.m. The peak hour demand for this portion of the system is 1.68 times the daily average and occurs at about 7:00 a.m.

Figure 4-5
Diurnal Curves

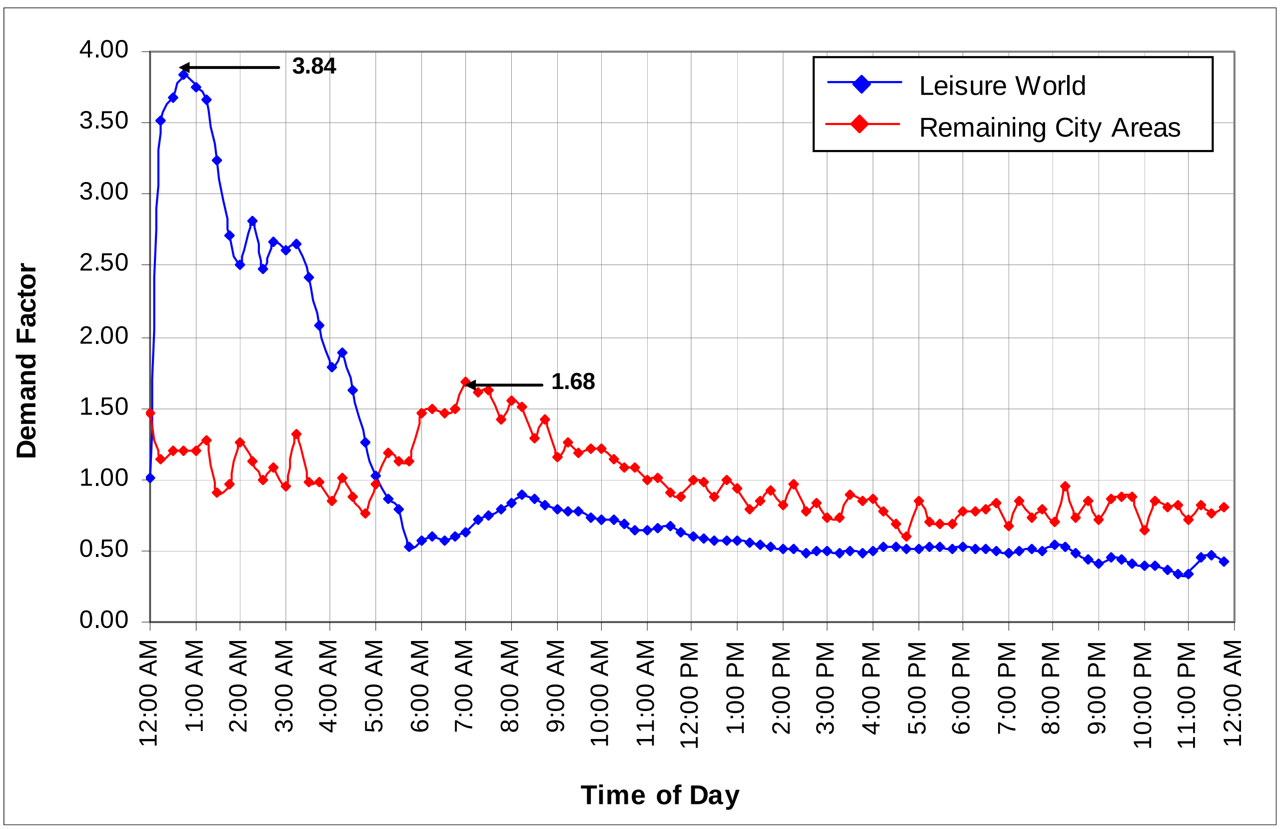


Table 4-3
Diurnal Demand Factors

Time of Day	Leisure World	Remain-ing City Areas	Total System	Time of Day	Leisure World	Remain-ing City Areas	Total System	Time of Day	Leisure World	Remain-ing City Areas	Total System
12:00 AM	1.01	1.46	1.34	8:00 AM	0.83	1.56	1.36	4:00 PM	0.50	0.86	0.76
12:15 AM	3.52	1.14	1.79	8:15 AM	0.89	1.50	1.34	4:15 PM	0.53	0.77	0.71
12:30 AM	3.68	1.21	1.88	8:30 AM	0.87	1.29	1.17	4:30 PM	0.53	0.69	0.64
12:45 AM	3.84	1.20	1.92	8:45 AM	0.81	1.41	1.25	4:45 PM	0.52	0.60	0.58
1:00 AM	3.76	1.20	1.90	9:00 AM	0.80	1.16	1.06	5:00 PM	0.51	0.85	0.76
1:15 AM	3.66	1.28	1.93	9:15 AM	0.77	1.26	1.13	5:15 PM	0.53	0.70	0.65
1:30 AM	3.23	0.90	1.54	9:30 AM	0.77	1.19	1.08	5:30 PM	0.53	0.69	0.65
1:45 AM	2.71	0.97	1.45	9:45 AM	0.74	1.22	1.09	5:45 PM	0.52	0.69	0.64
2:00 AM	2.50	1.25	1.60	10:00 AM	0.72	1.22	1.08	6:00 PM	0.52	0.78	0.71
2:15 AM	2.82	1.12	1.59	10:15 AM	0.71	1.15	1.03	6:15 PM	0.51	0.78	0.71
2:30 AM	2.47	1.00	1.40	10:30 AM	0.68	1.08	0.97	6:30 PM	0.51	0.79	0.71
2:45 AM	2.66	1.08	1.52	10:45 AM	0.64	1.08	0.96	6:45 PM	0.50	0.84	0.75
3:00 AM	2.61	0.96	1.41	11:00 AM	0.65	1.00	0.90	7:00 PM	0.48	0.67	0.62
3:15 AM	2.65	1.31	1.68	11:15 AM	0.67	1.02	0.92	7:15 PM	0.50	0.85	0.75
3:30 AM	2.41	0.98	1.37	11:30 AM	0.67	0.91	0.84	7:30 PM	0.52	0.73	0.67
3:45 AM	2.08	0.99	1.29	11:45 AM	0.63	0.87	0.81	7:45 PM	0.50	0.79	0.71
4:00 AM	1.79	0.85	1.11	12:00 PM	0.60	0.99	0.88	8:00 PM	0.54	0.70	0.66
4:15 AM	1.89	1.02	1.25	12:15 PM	0.59	0.99	0.88	8:15 PM	0.53	0.96	0.84
4:30 AM	1.63	0.88	1.09	12:30 PM	0.57	0.88	0.80	8:30 PM	0.48	0.73	0.67
4:45 AM	1.27	0.76	0.90	12:45 PM	0.57	0.99	0.88	8:45 PM	0.44	0.86	0.74
5:00 AM	1.03	0.97	0.99	1:00 PM	0.57	0.93	0.83	9:00 PM	0.42	0.71	0.63
5:15 AM	0.86	1.19	1.10	1:15 PM	0.56	0.80	0.73	9:15 PM	0.46	0.86	0.75
5:30 AM	0.79	1.12	1.03	1:30 PM	0.54	0.85	0.76	9:30 PM	0.43	0.88	0.76
5:45 AM	0.53	1.13	0.97	1:45 PM	0.52	0.92	0.81	9:45 PM	0.41	0.88	0.75
6:00 AM	0.58	1.46	1.22	2:00 PM	0.51	0.81	0.73	10:00 PM	0.39	0.64	0.57
6:15 AM	0.60	1.50	1.25	2:15 PM	0.51	0.97	0.84	10:15 PM	0.39	0.85	0.72
6:30 AM	0.57	1.46	1.21	2:30 PM	0.49	0.78	0.70	10:30 PM	0.36	0.81	0.68
6:45 AM	0.60	1.49	1.24	2:45 PM	0.50	0.83	0.74	10:45 PM	0.34	0.82	0.69
7:00 AM	0.63	1.68	1.39	3:00 PM	0.49	0.73	0.66	11:00 PM	0.34	0.72	0.62
7:15 AM	0.72	1.62	1.37	3:15 PM	0.48	0.73	0.66	11:15 PM	0.45	0.82	0.72
7:30 AM	0.74	1.63	1.39	3:30 PM	0.49	0.90	0.78	11:30 PM	0.46	0.76	0.68
7:45 AM	0.79	1.41	1.24	3:45 PM	0.48	0.86	0.75	11:45 PM	0.42	0.81	0.70

**Based on data collected between June 3, 2011 and June 6, 2011*

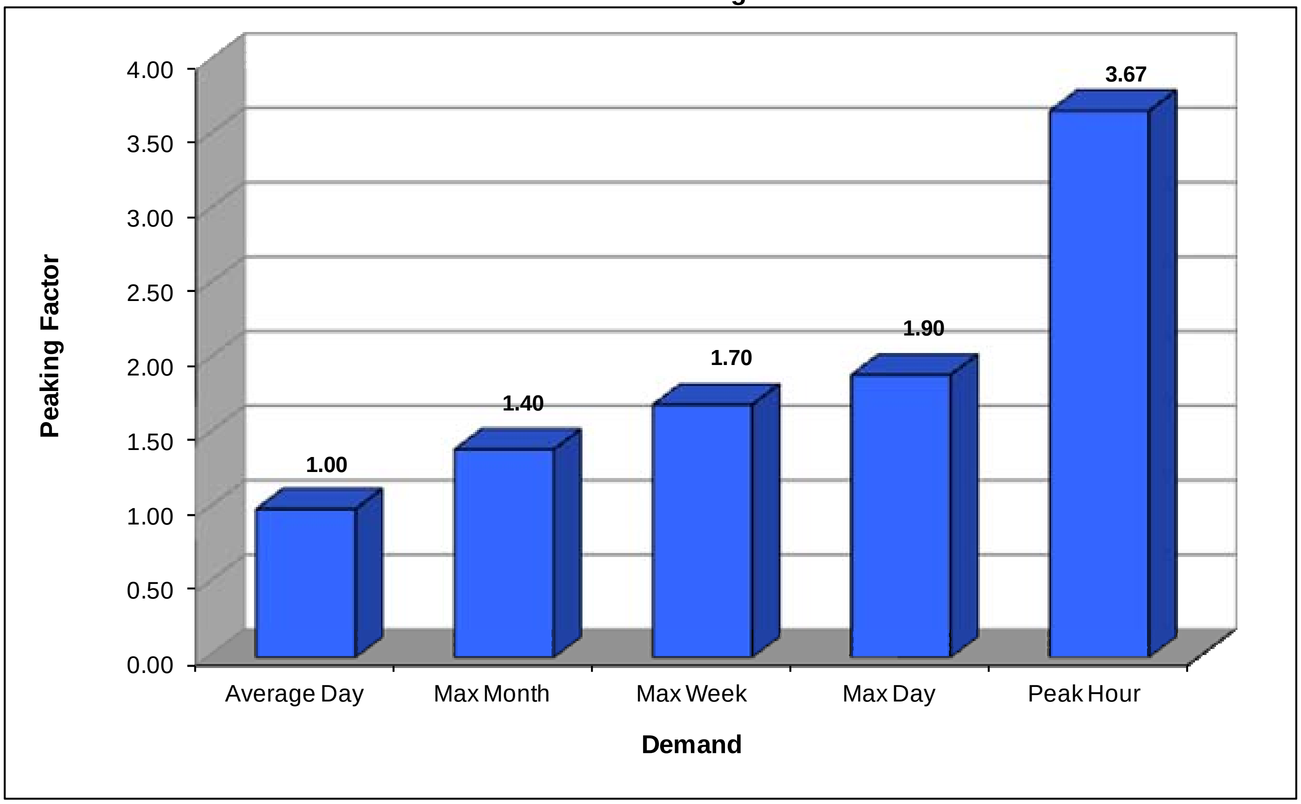
4-6 System Demands and Peaking Factors

It is important to evaluate a water system during various incremental peak demands. Typically, a water system is designed to meet the maximum demands placed on it. The system components must be designed to cope with these demands as they occur. Maximum month and maximum day demands are important factors in sizing a system's supply capability. Maximum day demands usually dictate the design criteria for both system transmission and storage needs. Peak hour criterion is a measure of the system's overall adequacy with respect to its transmission and distribution elements. The City of Seal Beach's water system demands utilized in this study are shown in Table 4-4. The relationships between the peaking factors developed for this study with respect to the average day demand estimate are displayed graphically on Figure 4-6.

Table 4-4
Water System Demands and Peaking Factors

Demand Description	Existing Demand (gpm)	(mgd)	(AFY)	Peaking Factor
Average Day	2,169	3.12	3,498	1.00
Max Month	3,036	4.37	4,897	1.40
Max Week	3,687	5.31	5,947	1.70
Max Day	4,120	5.93	6,646	1.90
Peak Hour	7,960	11.46	12,839	3.67

Figure 4-6
Water Demand Peaking Factors



Existing Demands

Average Day

The average day demand is based on the Seal Beach Water Purchase and Production data for the 2010-2011 fiscal year. The average day demand is approximately 2,169 gpm.

Maximum Month

The maximum month peaking factor was determined from the annual purchase and consumption records from 1999 to 2010. As shown in Table 4-2, the City's peak demand averages 1.31 times the average monthly demand. Between July 2001 and June 2011, the maximum peak demand ranged between 1.22 and 1.38. For prudent planning, this study utilizes a maximum month demand of 1.4 times the average day demand. The City's total maximum month demand is therefore 3,036 gpm.

Maximum Week

The maximum week demands are estimated to be approximately 1.7 times the average day demand or 3,687 gpm.

Maximum Day

The maximum day demand factors for beach communities in southern California similar to the City of Seal Beach range between 1.5 to 2.0 times the average day demands. The daily water production and purchase totals were evaluated for the City between November 2008 and October 2011. The annual maximum day water production and annual average day water production were analyzed during this period, and the City's maximum day demand factor was determined to be 1.76 (May 26, 2010). For prudent planning, this study utilized a maximum day demand of 1.9 times the average day demand. The City's total maximum day demand is therefore 4,120 gpm (1.9 x 2,169 gpm).

Peak Hour

The peak hour demands were based upon the two (2) diurnal demand curves illustrated on Figure 4-5. The overall peak hour system demand is estimated to be 3.67 times the average day demand or about 7,960 gpm. The Leisure World community has a significantly higher factor of 7.29, while the remaining City areas have a factor of 3.20. Estimates of the peak hour demands by location are shown in Table 4-5.

Table 4-5
Water System Demands by Zone

Zone	Average (gpm)	Maximum Month (gpm)	Maximum Week (gpm)	Maximum Day (gpm)	Maximum Day Peak Hour (gpm)	Maximum Day Peak Hour Factor
Leisure World	597	835	1,014	1,133	4,352	7.29
Remaining City Areas	1,572	2,201	2,673	2,987	5,024	3.20
Total	**2,169**	**3,036**	**3,687**	**4,120**	**	

*** Peaking does not occur at the same time of day*

Ultimate Demands

The City has identified one (1) planned area in Old Town community southwest of Marina Drive and First Street. The Bay City Partners LLC currently owns this property and proposes constructing a development that includes 48 residential units and 6.4 acres of open space land.

Because the City is nearly developed, large increases in population and water demands are not expected. The total City population increased from 24,168 persons in 2010 to 24,215 persons in 2011 *(Ref: California Department of Finance Demographic Research Unit).* This is less than a quarter of a percent increase. In addition, it is expected that any incremental increase in population and therefore water demands will be offset by the City's proactive and rigorous conservation efforts (See Section 4-10). As shown in Table 4-1, water consumption has been declining since the 2006-2007 fiscal year. Therefore, the ultimate demands are expected to be similar to the existing demands for this study.

4-7 High Water Users

Any account that showed an average water use of 5,000 gpd or more was considered a high water user for this study and is listed in Table 4-6.

Table 4-6
High Water Users

Address/Location	Account Number	Water Use (gpd)	Address/Location	Account Number	Water Use (gpd)
NAVAL BASE	003614-000	69,292	333 1ST ST	003694-000	8,183
2201 SEAL BEACH BLVD	004228-000	58,473	10 MARINA DR	026327-000	7,448
101 LOYOLA PZ	004976-000	35,437	CALTRANS	000705-000	7,312
2200 SEAL BEACH BLVD	003610-000	34,839	333 1ST ST	003701-000	7,220
NAVAL BASE MILITARY HOUSING	022654-000	32,668	12800 SEAL BEACH BLVD	005938-000	7,196
ARBOR PARK	012636-000	30,773	10 MARINA DR	004538-000	7,189
NAVAL BASE MILITARY HOUSING	022652-000	30,168	1801 BOLSA AV	000894-000	7,140
2201 SEAL BEACH BLVD	004227-000	28,299	12430 SEAL BEACH BLVD	025341-010	6,624
BLUEBELL PARK	012626-000	24,026	2401 SEAL BEACH BLVD	024244-000	6,597
CALTRANS	000706-000	22,105	450 PACIFIC COAST HY	015429-000	6,487
2200 SEAL BEACH BLVD	003611-000	21,113	CALTRANS	000704-000	6,368
4665 LAMPSON AV	004787-000	20,515	3010 OLD RANCH	022007-001	6,210
5201 LAMPSON AV	004783-000	16,420	3010 OLD RANCH	022007-005	6,124
CALTRANS	000703-000	13,953	12492 SEAL BEACH BLVD	005877-000	5,892
1801 BOLSA AV	003016-000	13,655	12280 SEAL BEACH BLVD	012972-000	5,402
2900 SEAL BEACH BLVD	003613-000	11,946	ADOLFO LOPEZ DR	000016-000	5,357
3850 LAMPSON AV	015622-000	11,856	12380 SEAL BEACH BLVD	024935-000	5,257
99 MARINA DR	005135-000	11,506	100 OCEAN AV	012572-000	5,150
CALTRANS	000707-000	11,055	3001 OLD RANCH PKWY	004798-000	5,140
1111 COAST HWY	019586-000	10,682	333 1ST ST	003700-000	5,128
600 MARINA DR	004057-000	9,323	5121 LAMPSON AV	004782-000	5,029
3900 LAMPSON AV	000425-000	8,643			

4-8 Water Conservation

Water conservation will continue to be an important issue as California's water storage and supply remain at critically low levels and as legislative mandates for reduced water consumption become law. The Water Conservation Act of 2009 (SBx7-7), was adopted in November 2009 to reduce the agricultural and urban water use throughout the State of California. The goal is to reach a 20 percent overall reduction in urban per capita water use statewide on or before December 31, 2020. Incremental progress must be shown by reducing per capital water use by 10 percent on or before December 31, 2015.

Per the City's *2010 Urban Water Management Plan*, the baseline daily per capita water use is set at 151.7 gallons per day per capita (gpcd). The City's 2020 target is 139.5 gpcd. This is an eight percent decrease in per capita water use. To achieve this target, the City plans to continue its water conservation effort with its existing demand management measures which are as follows:

- Signatory to the California Urban Water Conservation Council's (CUWCC) Best Management Practices (BMPs) Memorandum of Understanding (MOU) since 2000
- Residential Survey Program which provides a water survey to high water residential users
- Smart Time Rebate Program which provides rebates for users that purchase and install weather based irrigation controllers
- Rotating Nozzle Rebate Program which provides rebates for the purchase and installation of rotary nozzles in existing irrigation systems
- Synthetic Turf Rebate Program which provides rebates for synthetic turf projects
- California Friendly Landscape Training hosted by MWDOC which provides educational training on landscape water efficiency practices
- Regional Plumbing Retrofit Program involved the City's participation with MWDOC to distribute low flow showerheads throughout the City
- Ultra Low Flow Toilet Rebate Program and High Efficiency Toilet Rebate Program
- Water Audit and Leak Detection programs includes valve exercising and meter calibration
- Volumetric Billing based on metered water use
- Water Smart Landscape Program to assist agencies to track and manage water use
- Water Efficient Landscape Ordinance was adopted on January 11, 2010 by the City to minimize landscape water usage
- High Efficiency Washing Machine Rebate Program provides rebates to residents who purchase high efficiency clothes washers
- Public Information Programs include educating the public through bill inserts, brochures, website, and community events
- MWDOC Regional Public Information Programs are open to residents of the City and include educational trips to water facilities, the O.C. Water Hero Program, Water Advisory Committee of Orange County and a monthly newsletter.
- School Education Programs are provided by the City with MWDOC and include presentations, a water conservation poster and slogan contest, and the Children's Water Education Festival.

- Save a Buck Rebate Program provides rebates to commercial, industrial, and institutional customers for replacing high-flow plumbing fixtures with low-flow fixtures.
- Water Smart Hotel Program is provided by MWDOC to provide hotels surveys and incentives to reduce water use
- Industrial Process Water Use Reduction Program is funded by outside agencies to provide industrial customers engineering surveys of possible water saving recommendations
- Adoption of City Ordinance 1586 in 2009 which includes the following updated water conservation provisions:
    - Leak repair
    - Prevention of water runoff
    - Limits of watering hours
    - Limits on duration of watering
    - Restaurant water service upon request only
    - Water use restrictions at water fountains and decorative features
    - No single pass cooling systems
    - Restrictions on the installation of commercial non-re-circulating water systems for car wash and laundry systems
    - Restrictions on vehicle washing

SECTION 5

WATER SUPPLY

5-1 Sources of Supply

The City's potable water supply consists of imported water from Metropolitan Water District of Southern California (MWD) through Municipal Water District of Orange County (MWDOC) and the West Orange County Water Board (WOCWB) and groundwater from the Orange County Groundwater Basin through the City's four (4) wells. Detailed purchase and production data is shown in Table 4-1.

Poseidon Resources Corporation (Poseidon) proposes to construct and operate a 50 million gallon per day (mgd) seawater desalination facility in the City of Huntington Beach. The City of Seal Beach has signed a letter of interest to purchase water from this proposed facility, if the project is constructed. As more information becomes available, the City should evaluate the feasibility of adding the desalinated water supply to its water supply.

5-2 Imported Water Supply

Water is imported into Southern California through two major water supply systems:

1. The Colorado River Aqueduct, constructed and operated by Metropolitan Water District of Southern California (MWD), transports water from the Colorado River to MWD's service area

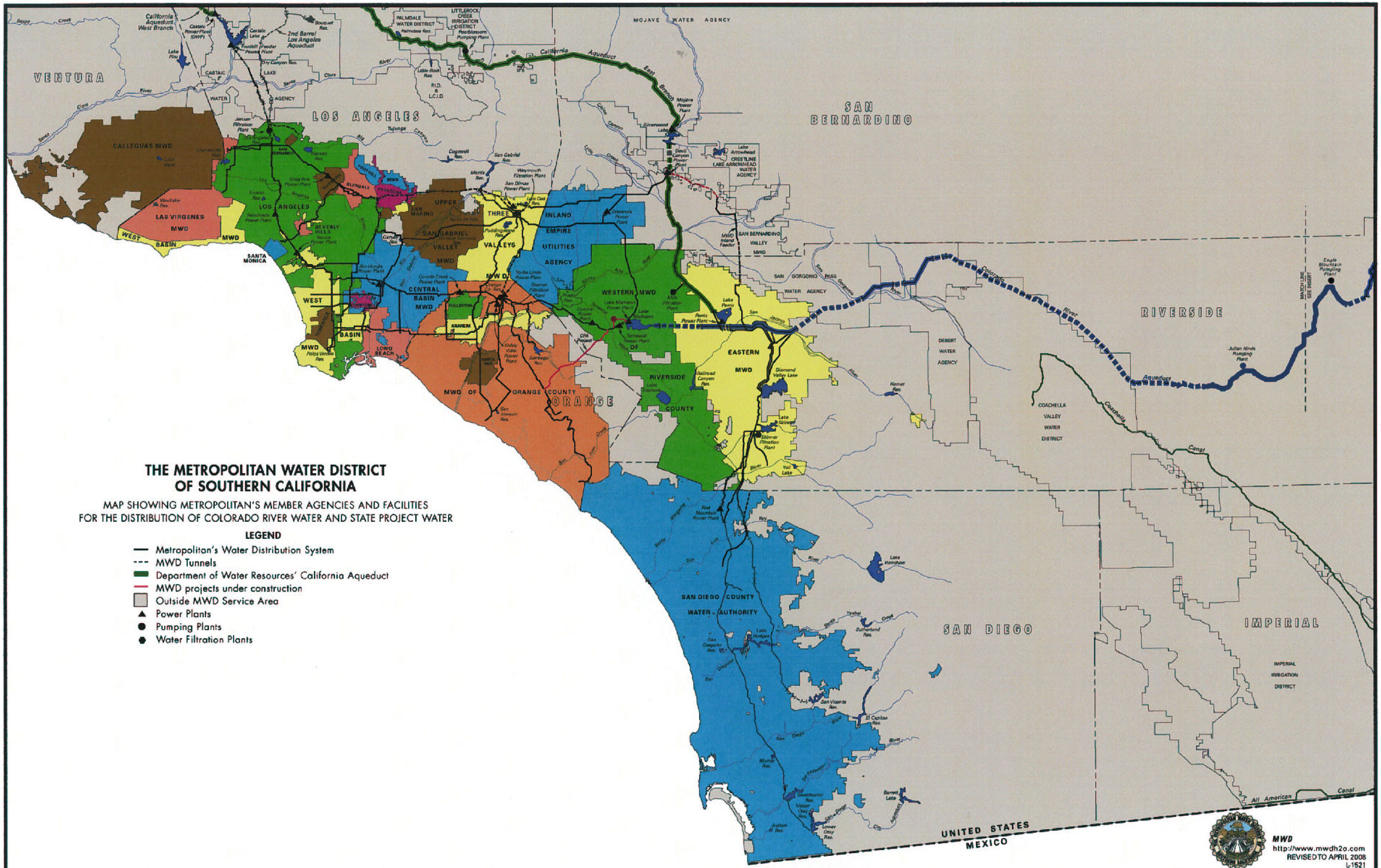
2. The State Water Project, owned and operated by the State of California Department of Water Resources (DWR), transports water from the Sacramento-San Joaquin Delta through the California Aqueduct

5-2.1 Metropolitan Water District of Southern California and Municipal Water District of Orange County

MWD is the purveyor of imported water for most of Southern California. It provides supplemental water to 26 member public agencies through a regional distribution network of canals, pipelines, reservoirs, treatment plants, pump stations, hydropower plants and other appurtenances. The MWD service area is illustrated on Figure 5-1.

Los Angeles, Orange, and Ventura Counties are encompassed within MWD's Central Pool service area that accounts for more than 60 percent of MWD's total demand for supplemental water. The Central Pool service area is served by three MWD water treatment plants: the Joseph Jensen Plant in Granada Hills, the Weymouth Plant in La Verne, and the Diemer Plant in Yorba Linda. Each of these plants serves a localized exclusive area as well as a portion of a common area of the Central Pool, known as the 'Common Pool'. As shown on Figure 5-2, the City of Seal Beach is encompassed within the Common Pool service area.

The Metropolitan Water District of Southern California prepared an Integrated Water Resources Plan in 1997. This plan estimated that the demands of the Common Pool area would exceed the treated water capacity available by the summer of 2013. Additional treated water capacity would be needed in the Common Pool



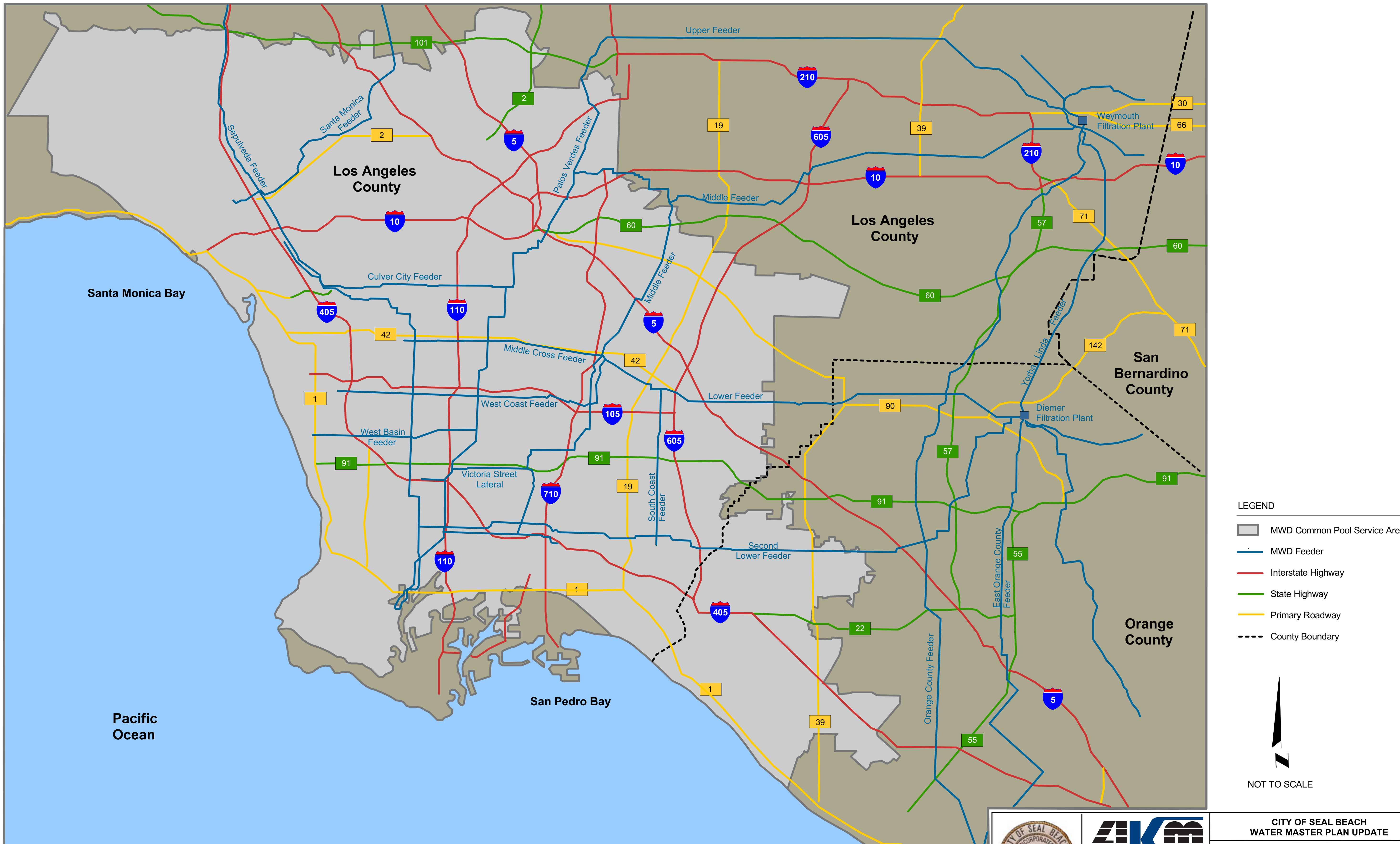
CITY OF SEAL BEACH
WATER MASTER PLAN UPDATE

PROJECT NO: 0801070.00

DATE: July 2012

Metropolitan Water District Service Area

Figure 5-1



Reference: Southern California's Integrated Water Resources Plan, December 1995, Metropolitan Water District of Southern California

PROJECT NO.: 0801070.00

DATE: July 2012

CITY OF SEAL BEACH
WATER MASTER PLAN UPDATE

MWD Common Pool Service Area

Figure 5-2

area due to limitations in MWD treatment plant capacity and conveyance facilities. The additional amount of treated water needed was estimated to be 286 cfs by the year 2020.

MWD updated its IRP in 2004 and 2010. The updates generally addressed the uncertainties in the water demand targets, which were observed to be lower than predicted due to increased water conservation and increases in local supply. The 2010 IRP indicates that MWD has the resources to provide the expected demand for the next 25 years. The future supply may be increased through further water conservation efforts, local supply development, storage programs and improvements to the Sacramento-San Joaquin Delta. According to the MWDOC Urban Water Management Plan, the Metropolitan Water District of Southern California is capable of providing the projected MWDOC water demands for the next 25 years, as well.

Imported water is supplied to Seal Beach by the Municipal Water District of Orange County (MWDOC) via West Orange County Water Board (WOCWB), which is a joint powers agency formed in 1955 for the purpose of providing a dependable imported water supply to its member agencies. The original members of the WOCWB were the Cities of Seal Beach and Huntington Beach, and Orange County Waterworks District No. 3 and No. 5. The City of Garden Grove acquired the rights and interest of Waterworks District No. 3 in 1960. In 1965, the City of Westminster acquired the rights and interests of Waterworks District No. 5. The City of Huntington Beach operates the WOCWB system under contract to the Board, and communicates with MWDOC and MWD for the requested flows.

MWDOC supplies the imported water WOCWB member agencies through two (2) turnouts, OC-9 and OC-35. WOCWB Feeder No. 1 originates at OC-9 and conveys water to the Cities of Huntington Beach and Westminster. WOCWB Feeder No. 2 originates at OC-35 and conveys water to the Cities of Huntington Beach, Garden Grove, Westminster, and Seal Beach.

OC-35 is located in the City of Stanton on Dale Street north of Katella Avenue as shown on Figure 5-3. Feeder No. 2 starts at OC-35, extends west in Katella Avenue, south in Knott Street, west in Garden Grove Boulevard, south in Edwards Street, west in Westminster Boulevard, and south in Springdale Street to the Seal Beach turnout. Feeder No. 2 is 36-inch in diameter between OC-35 and Chapman Avenue, 33-inch between Chapman Avenue and Westminster Boulevard and 27-inch in Springdale Street. It is a shared facility and also has a City of Westminster turnout.

The maximum flow capacity at the Seal Beach turnout is 10 cfs (4,490 gpm) and the available pressure is approximately 115 psi, depending on the usage of other customers. The flowrate and downstream pressures are regulated with a CLA VAL pressure regulating valve. The City generally maintains a flowrate of 5 cfs (2,244 gpm) and pressures between 75 and 80 psi. Currently, the City imports water during the warmer months, generally between June and October.

From the WOCWB connection, flow is conveyed westerly on Westminster Boulevard to Bolsa Chica Road via an 18-inch cement mortar lined steel pipe. From this intersection, a 12-inch asbestos cement pipe (ACP) conveys the water north along Bolsa Chica Road to College Park East and an 18-inch cement mortar lined steel pipe conveys the water west along Westminster Boulevard.

CITY OF SEAL BEACH
WATER MASTER PLAN UPDATE

WOCWB Feeder No. 2
Location Map

Figure 5-3

5-2.2 Imported Water Quality

Table 5-1 provides a summary of the imported water quality per the City's 2010 Water Quality Report. All primary and secondary drinking water standards have been satisfied.

Table 5-1
2010 MWD Treated Surface Water Quality

Chemical	MCL	PHG or (MCLG)	Average Amount	Range of Detections	ML Violation?	Typical Source of Contamination
Radiologicals – Tested in 1999						
Alpha Radiation (pCi/L)	15	0	5.6	3.8 - 9.3	No	Erosion of natural deposits
Beta Radiation (pCi/L)	50	0	4.3	ND - 6.4	No	Decay of Man-made or natural deposits
Uranium pCi/L)	20	0.42	3.3	2.9 - 3.7	No	Erosion of natural deposits
Inorganic Chemicals – Tested in 2002						
Aluminum (ppm)	1	0.6	0.17	0.07 - 0.23	No	Treatment Process Residue, Natural Deposits
Arsenic (ppb)	10	0.004	2.3	ND - 2.8	No	Erosion of natural deposits
Barium (ppm)	1	2	0.11	ND - 0.12	No	Erosion of natural deposits
Fluoride (ppm) Treatment - related	Control Range 0.7 - 1.3 ppm		0.8	0.4 - 1.0	No	Erosion of natural deposits
Second Standards* - Tested in 2002						
Aluminum (ppm)	200*	600	170	66 - 230	No	Treatment Process Residue, Natural Deposits
Chloride (ppm)	500*	n/a	93	83 - 93	No	Runoff or leaching from natural deposits
Color (color Units)	15*	n/a	1	2-Jan	No	Runoff or leaching from natural deposits
Odor (threshold odor number)	3*	n/a	2	2-Jan	No	Naturally-occuring Organic Materials
Specific Conductance (µmho/cm)	1,600*	n/a	970	460 - 1,000	No	Substances that form ions in water
Sulfate (ppm)	500*	n/a	230	160 - 240	No	Runoff or leaching from natural deposits
Total Dissolved Solids (ppm)	1,000*	n/a	590	470 - 610	No	Runoff or leaching from natural deposits
Turbidity (NTU)	5*	n/a	0.04	0.03 - 0.16	No	Runoff or leaching from natural deposits
Unregulated Chemicals – Tested in 2002						
Alkalinity (ppm_	Not Regulated	n/a	110	67 - 120	n/a	Runoff or leaching from natural deposits
Boron (ppb)	Not Regulated	n/a	120	120 - 130	n/a	Runoff or leaching from natural deposits
Calcium (ppm)	Not Regulated	n/a	66	51 - 70	n/a	Runoff or leaching from natural deposits
Magnesium (ppm)	Not Regulated	n/a	27	22 - 28	n/a	Runoff or leaching from natural deposits
pH (pH units)	Not Regulated	n/a	7.9	7.5 - 8.0	n/a	Hydrogen ion concentration
Potassium (ppm)	Not Regulated	n/a	4.7	3.9 -4.8	n/a	Runoff or leaching from natural deposits
Sodium (ppm)	Not Regulated	n/a	95	78 - 95	n/a	Runoff or leaching from natural deposits
Total Organic Carbon (ppm)	Not Regulated	n/a	2.2	1.9 - 2.3	n/a	Various Natural and Man-made Sources
Vanadium (ppb)	Not Regulated	n/a	3	ND - 3.3	n/a	Runnoff or leaching from Natural Deposits
Hardness (ppm)	Not Regulated	n/a	270	92 - 300	n/a	Runoff or leaching from natural deposits
Hardness (grains/gal)	Not Regulated	n/a	16	5.4 - 18	n/a	Runoff or leaching from natural deposits
ppb = parts-per-billion; ppm = parts-per million; pCi/L = picoCuries per liter; NTU = nephelometric turbidity unit; ND – not detected; , = average is less than the detection limit for reporting purposes;MCL – Maximum Contaminant Level; (MCLG) = federal MC						
* Contaminant is regulated by a secondary standard to remain aesthetic qualities (taste, odor, color).						

5-3 Groundwater Supply

The City of Seal Beach has four (4) active wells, which provide groundwater from the Main Orange County Groundwater Basin. The groundwater basin is approximately 229,000 acres in size and has historically provided over 300,000 AFY to the residents of Orange County.

The Orange County Water District (OCWD) was formed in 1933 to protect the underground water supply and legal rights of landowners of the Coastal Plain. In the previous decade, the Main Orange County Groundwater Basin experienced an average drop of 77 feet and artesian wells were gradually disappearing. The Santa Ana River was the primary source of basin replenishment but less and less water was carried into the Orange County area due to below average rainfall conditions as well as expansion of upstream storage and spreading operations. OCWD did not adjudicate the groundwater basin; users could pump from the basin as much water as needed.

Since its formation, OCWD has had to deal with decreasing groundwater levels, overdraft, and seawater intrusion, which was caused by drought conditions and increased population growth. Actions taken by OCWD to protect the groundwater basin include the following:

- 1948 - Began purchasing Colorado River water from MWD for recharge
- 1953 - Amended District Act to include replenishment assessment and require semi-annual reporting of groundwater extractions
- 1969 - Adopted conjunctive use policy
- 1960's – Participated in seawater barrier operations (Alamitos Barrier and Talbert Gap)
- 1968 – Amended District Act to include basin production percentage and basin equity assessment
- 1970's – Expanded recharge operations
- 1970's – Constructed Water Factory 21 (recycled water facility) and 23 injection wells at Talbert Gap
- 1989 – Developed Groundwater Management Plan, program to increase water supplies, clean up contamination, and improve basin management
- 1991 – Completed Green Acres Project (recycled water facility)
- 2008 – Began operating Ground Water Replenishment System, providing recharge water for Talbert Injection Barrier and recharge basins in the City of Anaheim

OCWD sets the Basin Production Percentage (BPP) to regulate the local groundwater production. The BPP is the percent of the member agencies' total demand that can be pumped from the groundwater basin. It applies only to water producers who pump over 25 AFY. The BPP is set uniformly for all producers on an annual basis. The BPP has historically ranged from 60 percent to 80 percent. The BPP was 62 percent for 2009-2010 and 2010-2011.

Per the OCWD 2009-2010 Engineer's Report, there were 21 major producers that pumped 275,898 acre feet in 2009-2010 water year. The City of Seal Beach pumped 2,222 AF in the 2009-2010 water year. The remaining 1,446 AF was imported water. The City's percentage of groundwater pumped was therefore 60.5 percent of the total demand, which is less than the 2009-2010 BPP (62 percent).

Groundwater pumped by a producer at or below the BPP is assessed as the Replenishment Assessment. Water pumped above the BPP is subject to significant levies in the form of a Basin Equity Assessment. OCWD uses the revenue collected from the Basin Equity Assessment to fund MWD water that is purchased for groundwater replenishment. Therefore, the Basin Equity Assessment is based on the current price of MWD water.

OCWD regulates the groundwater levels in the Main Orange County Groundwater Basin by regulating the overdraft within the groundwater basin, which is the difference between the full basin volume and the actual basin volume. According to the 2009 OCWD Groundwater Management Plan, the basin's full capacity is approximately 66,000,000 AF. In general, OCWD tries to maintain an overdraft between 100,000 AF and 434,000 AF. OCWD tries to keep the basin nearly full to prevent seawater intrusion, increased pumping costs, lack of emergency storage, possible land subsidence, and migration of poor quality water.

5-3.1 Groundwater Recharge and Protection

The groundwater basin consists of the shallow aquifer system, principal aquifer system, and deep aquifer system. The shallow aquifer system is closest to the ground surface; however, it only provides about 5 percent of the basin production due to its small size. The principal aquifer system is located below the shallow aquifer system, and it provides the majority of the groundwater production, due to its larger size and water quality. Below the principal aquifer system is the deep aquifer system, which is generally not economically feasible to pump from. The deep aquifer system is also categorized by colored water.

Sources of the Main Orange County Groundwater Basin recharge and protection are the OCWD In-Lieu Program, natural replenishment, Santa Ana River, and Seawater Barriers.

OCWD In-Lieu Program

When there is an abundance of imported water from MWD, OCWD may enact the In-Lieu Program where imported water may be purchased instead of pumping groundwater. In turn, this will help to recharge the basin.

Natural Replenishment

Natural replenishment of the groundwater basin generally occurs in the north western portion of the Main Orange County Groundwater Basin, where there is less clay and silt deposits that separate the shallow and primary aquifers.

Santa Ana River

Recharge water consists of natural recharge, imported water, and water purified by OCWD's Groundwater Replenishment (GWR) system. The Santa Ana River and the Santiago Creek provide the majority of the groundwater basin's source of recharge water.

OCWD groundwater recharge facilities are generally located in the Cities of Anaheim and Orange. They include the Main River System, the Off-River system, the Deep Basin System, and the Burris Basin/Santiago System.

The Main River System consists of 290 acres of the Santa Ana River.

The Off-River System is a sandy-bottom channel that parallels the Santa Ana River. Water from the Santa Ana River is diverted to the Off-River System by the Imperial Inflatable Dam.

The Deep Basin System consists of large recharge basins that range in depth of 10 to 60 feet, and it is supplied by the Off-River System. The following basins are included in the deep basin system:

- Raymond Basin
- Placentia Basin
- La Jolla Basin
- Kraemer Basin
- Miller Basin
- Anaheim Lake
- Mini Anaheim Lake
- Foster Huckleberry Basin
- Conrock Basin
- Warner Basin
- Little Warner Basin

The Burris Basin/Santiago System is supplied by Santa Ana River water that is diverted by the Five Coves Inflatable Dam to the Burris Basin, which parallels the Santa Ana River. Excess flows are diverted from the Burris Basin to the Santiago Basins, which include the following:

- Smith Basin
- Blue Diamond Basin
- Bond Basin

Seawater Barriers

OCWD provides a combination of imported and purified water from the GWR system to inject into the Alamitos and Talbert Barriers.

The Alamitos Barrier was created to minimize seawater intrusion near the Orange County and Los Angeles County boundary, to the north of the City of Seal Beach. It consists of 43 injections wells, four (4) extraction wells, and 226 observation wells. The Los Angeles County Department of Public Works (LACDPW) and OCWD provide joint funding and management of the barrier. According to the OCWD 2009-2010 Engineer's Report, 1,321 AF was injected into the Alamitos Barrier by OCWD in the 2009-2010 water year.

The Talbert Barrier spans approximately 2.5 miles between the Newport and Huntington Beach mesas. According to the OCWD 2009-2010 Engineer's Report, 36,510 AF was injected in the Talbert Barrier by OCWD in the 2009-2010 water year.

5-3.2 Groundwater Level

According to the 2009-2010 OCWD Engineer's Report, the groundwater levels in the Main Orange County Groundwater Basin rose 10 feet in the shallow aquifer system in the 2009-2010 water year. The principal and deep aquifer systems experienced increases in the groundwater levels up to 20 feet and 15 feet respectively.

Seal Beach is located in the Coastal portion of the groundwater basin, which is protected from seawater intrusion by the Alamitos Barrier. According to the City staff, the following groundwater levels were observed on July 25, 2011.

- Beverly Manor Well: 28-feet below sea level (Depth of 39 feet)
- Leisure World Well: 30-feet below sea level (Depth of 40 feet)
- Bolsa Chica Well: 32-feet below sea level (Depth of 53 feet)
- Lampson Avenue Well: 18-feet below sea level (Depth of 40 feet)

5-3.3 Groundwater Quality

The City's 2010 Water Quality Report shows that groundwater served meets and exceeds all primary and secondary drinking water standards as shown in Table 5-2.

The groundwater quality is monitored by OCWD. According to the OCWD 2009 Groundwater Management Plan, OCWD takes almost 14,000 groundwater samples, annually, from its 700 monitoring wells. Water sampling is performed to monitor the chemicals regulated by the U.S. Environmental Protection Agency (EPA) and the California Department of Public Health (CDPH). It is also performed to assess the seawater intrusion and to evaluate the surface water quality of the Santa Ana River, which is used to recharge the groundwater basin.

The groundwater pumped from the Main Orange County Groundwater Basin via the City's four (4) wells is treated onsite with sodium hypochlorite before it is distributed into the system.

Table 5-2
2010 Groundwater Quality

Chemical	MCL	PHG (MCLG)	Average Amount	Range of Detections	ML Violation?	Most Recent Sampling Date	Typical Source of Contamination
Radiologicals – Tested in 2009							
Uranium pCi/L)	20	0.43	<1	ND – 2.7	No	2009	Erosion of natural deposits
Inorganic Chemicals – Tested in 2002							
Fluoride (ppm)	2	1	0.45	0.39 – 0.55	No	2010	Erosion of natural deposits
Arsenic (ppb)	10	0.004	<2	ND - 2.0	No	2010	Erosion of natural deposits
Second Standards* - Tested in 2010							
Chloride (ppm)	500*	n/a	17	12 – 23	No	2010	Erosion of natural deposits
Color (color Units)	15*	n/a	5.5	ND – 15	No	2010	Erosion of natural deposits
Odor (threshold odor number)	3*	n/a	<1	ND - 2.0	No	2010	Erosion of natural deposits
Specific Conductance (µmho/cm)	1,600*	n/a	373	234 - 395	No	2010	Erosion of natural deposits
Sulfate (ppm)	500*	n/a	37	35 - 41	No	2010	Erosion of natural deposits
Total Dissolved Solids (ppm)	1,000*	n/a	215	200 - 240	No	2010	Erosion of natural deposits
Turbidity (ntu)	5*	n/a	0.1	ND -0.2	No	2010	Erosion of natural deposits
Unregulated Contaminants Requiring Monitoring							
Bicarbonate (ppm)	Not Regulated	n/a	160	143-183	n.a.	2010	Erosion of natural deposits
Calcium (ppm)	Not Regulated	n/a	23	14 - 30	n.a.	2010	Erosion of natural deposits
Magnesium (ppm)	Not Regulated	n/a	3	1.3 - 5.7	n.a.	2010	Erosion of natural deposits
pH (pH units)	Not Regulated	n/a	8.3	8.1 - 8.6	n.a.	2010	Acidity, hydrogen ions
Potassium (ppm)	Not Regulated	n/a	1.5	1.3 - 1.7	n.a.	2010	Erosion of natural deposits
Sodium (ppm)	Not Regulated	n/a	58	43 – 73	n.a.	2010	Erosion of natural deposits
Total Alkalinity (ppm as $CaCO^3$)	Not Regulated	n/a	135	127 - 150	n.a.	2010	Erosion of natural deposits
Total Hardness (ppm as $CaCO^3$)	Not Regulated	n/a	69	39 - 99	n.a.	2010	Erosion of natural deposits

5-4 Poseidon Desalination Facility

Poseidon Resources Corporation proposes to construct and operate a 50 million gallon per day (mgd) seawater desalination facility in the City of Huntington Beach. The desalination facility is proposed to be built south east of the Huntington Beach Channel and Newland Street, and it will provide reverse osmosis desalination treatment of approximately 100 mgd to produce approximately 50 mgd of potable drinking water. The project will also require the construction of or improvements to water delivery pipelines and pump stations to supply the Orange County water purveyors. Poseidon is working with State agencies to finalize the necessary permits for this project.

Along with 15 other nearby agencies, the City of Seal Beach has signed a letter of interest to purchase water from this proposed facility. As more information becomes available, the City should evaluate the feasibility of adding the desalinated water supply to its water supply, if the project is constructed. Water usage and delivery agreements will need to be reviewed amongst the following agencies:

- The City of Seal Beach
- Poseidon Resources Corporation
- Municipal Water District of Orange County
- West Orange County Water Board

The preliminary analysis consists of constructing a transmission line from the Poseidon desalination plant to the MWDOC turnouts OC-9 and OC-35, which could serve Seal Beach directly through WOCWB.

SECTION 6

EXISTING WATER SYSTEM

6-1 General

The City of Seal Beach's domestic water system consists of the following:

- 73.4 Miles of pipe ranging in size from 4-inches to 20-inches in diameter
- 2 Booster pump stations (Navy and Beverly Manor)
- 2 Forebay reservoirs with a total capacity of 7 million gallons (Navy and Beverly Manor)
- 4 Active wells (Leisure World, Beverly Manor, Bolsa Chica, and Lampson Avenue)
- 1 Imported water supply connection (West Orange County Water Board {WOCWB} through Metropolitan Water District OC-35 Connection)
- Emergency connections with the City of Long Beach, the City of Huntington Beach, the City of Westminster, and the Golden State Water Company
- Partially completed SCADA system
- 680 fire hydrants
- Approximately 5,677 potable water services

Table 6-1
Existing Potable Water Meters

Customer Type	Number of Meters
Residential	5,186
City	90
Commercial	401
Other	27
Total	**5,677**

The number of services by customer type is shown in Table 6-1. The City provides service to the customers within the City boundaries, as well as customers in the Cities of Los Alamitos and Garden Grove. The Garden Grove customers, located north east of Lampson Avenue and Lunar Drive are served water from the City of Seal Beach via the Golden State Water Company.

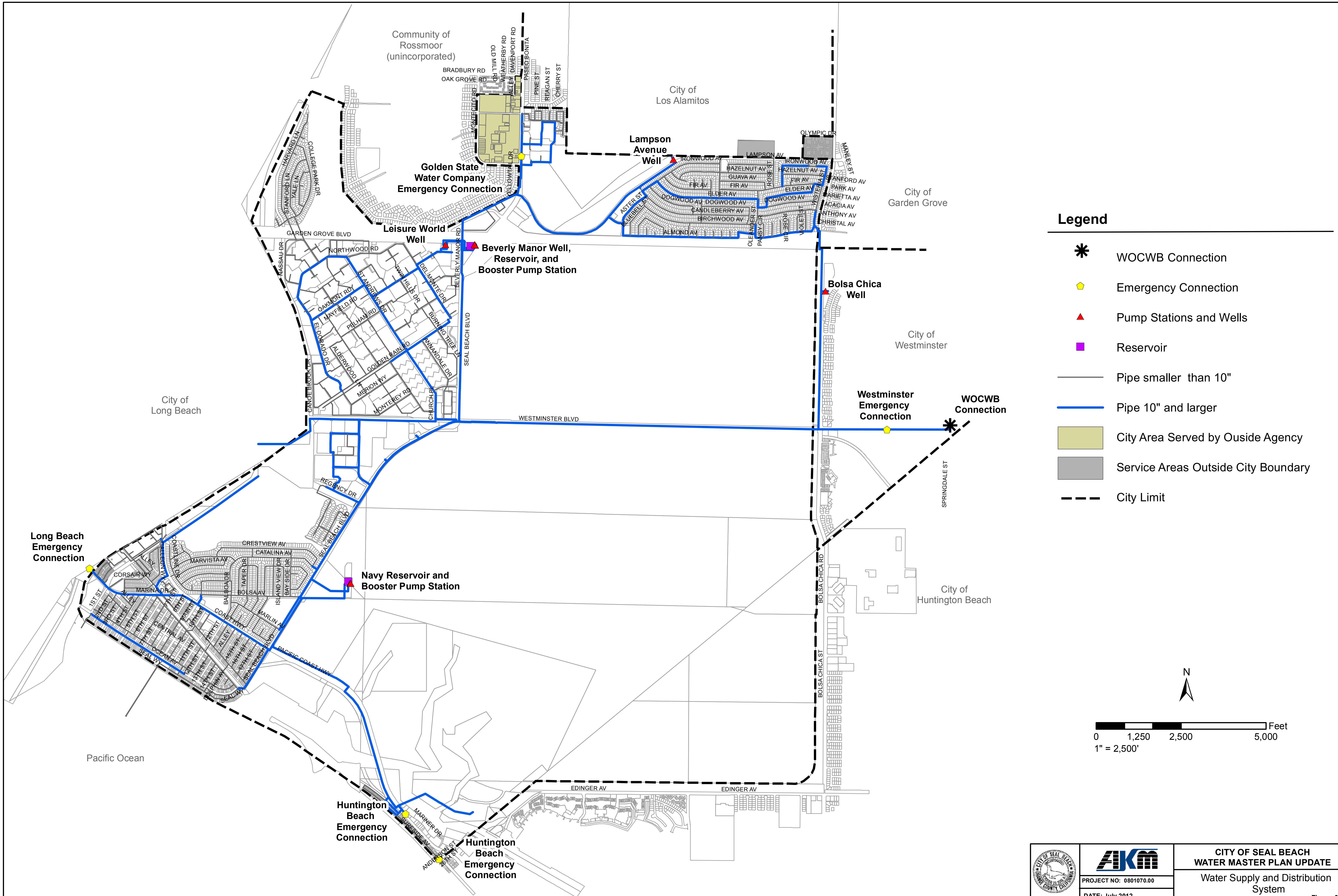
The Rossmoor Commercial Center and the apartment complexes located to the west of this center are served by the Golden State Water Company. It is recommended that the City perform a feasibility study to incorporate these users into the City's system.

The existing potable water system is shown on Figure 6-1.

6-2 Pressure Zone and General Operations

Aside from the Marina Hill community, the study area is generally characterized by flat terrain. Therefore, multiple pressure zones are not required. The City's water system is a single zone closed system without a free-water surface. System pressure is maintained through the pressure at the imported water supply connection, and the pumping at varying speeds based upon demand at the (2) booster pump stations, Bolsa Chica Well, and Lampson Avenue Well.

The West Orange County Water Board Feeder No. 2 is capable of providing approximately 115 psi at the City turnout, located at the southwest corner of Westminster Boulevard and Springdale Street. The City has maintained 75 to 80 psi on its side of the turnout.



Community of Rossmoor (unincorporated)
City of Los Alamitos
City of Garden Grove
City of Westminster
City of Long Beach
City of Huntington Beach
Pacific Ocean
Lampson Avenue Well
Golden State Water Company Emergency Connection
Leisure World Well
Beverly Manor Well, Reservoir, and Booster Pump Station
Bolsa Chica Well
Westminster Emergency Connection
WOCWB Connection
Long Beach Emergency Connection
Navy Reservoir and Booster Pump Station
Huntington Beach Emergency Connection
Huntington Beach Emergency Connection
GARDEN GROVE BLVD
WESTMINSTER BLVD
SEAL BEACH BLVD
BOLSA CHICA RD
EDINGER AV
PACIFIC COAST HWY
SPRINGDALE ST
Legend
WOCWB Connection
Emergency Connection
Pump Stations and Wells
Reservoir
Pipe smaller than 10"
Pipe 10" and larger
City Area Served by Ouside Agency
Service Areas Outside City Boundary
City Limit
N
0 1,250 2,500 5,000 Feet
1" = 2,500'
PROJECT NO: 0801070.00
DATE: July 2012
CITY OF SEAL BEACH
WATER MASTER PLAN UPDATE
Water Supply and Distribution System
Figure 6-1

The Beverly Manor Booster Pump Station, Navy Booster Pump Station, Bolsa Chica Well, and Lampson Avenue Well, pump directly into the distribution system. Table 6-2 details the typical operational pressure settings that the City maintains at these facilities.

Table 6-2
City Operational Pressure Settings

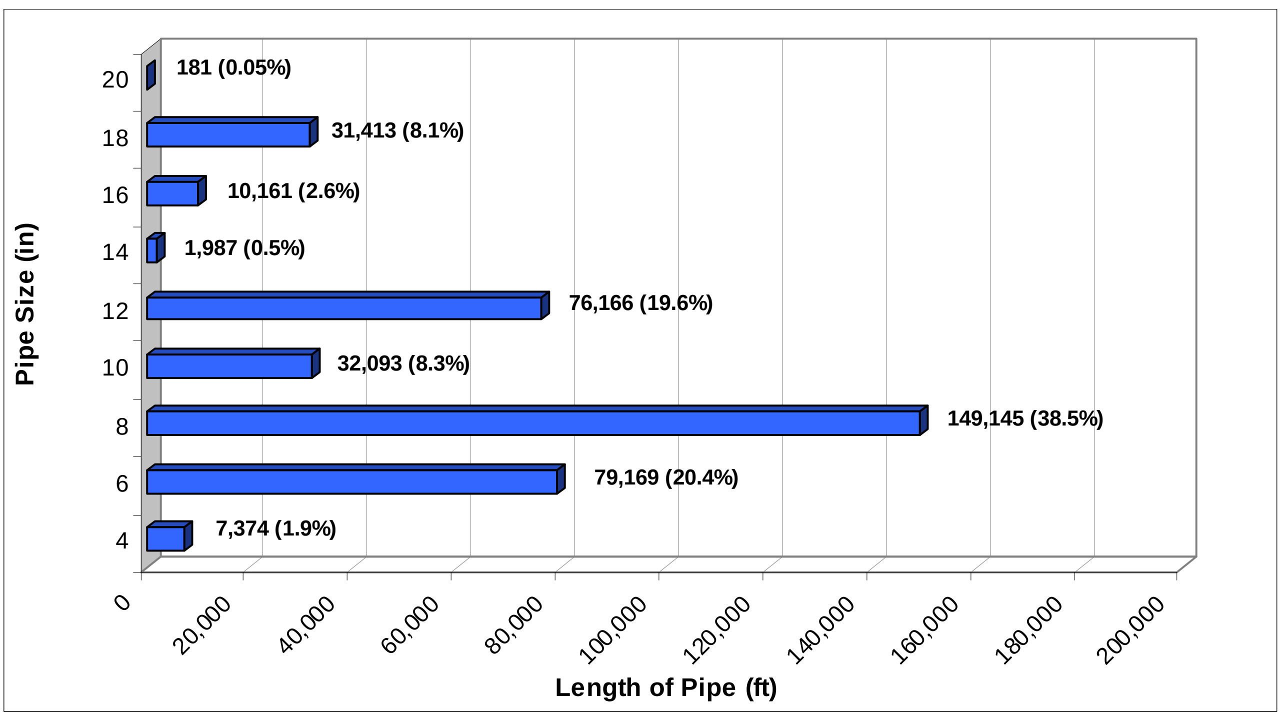
Facility	Pressure Setting (psi)
Beverly Manor Pump Station	60 - 66
Navy Booster Pump Station	58 - 62
Bolsa Chica Well	60 - 65
Lampson Avenue Well	60 - 65

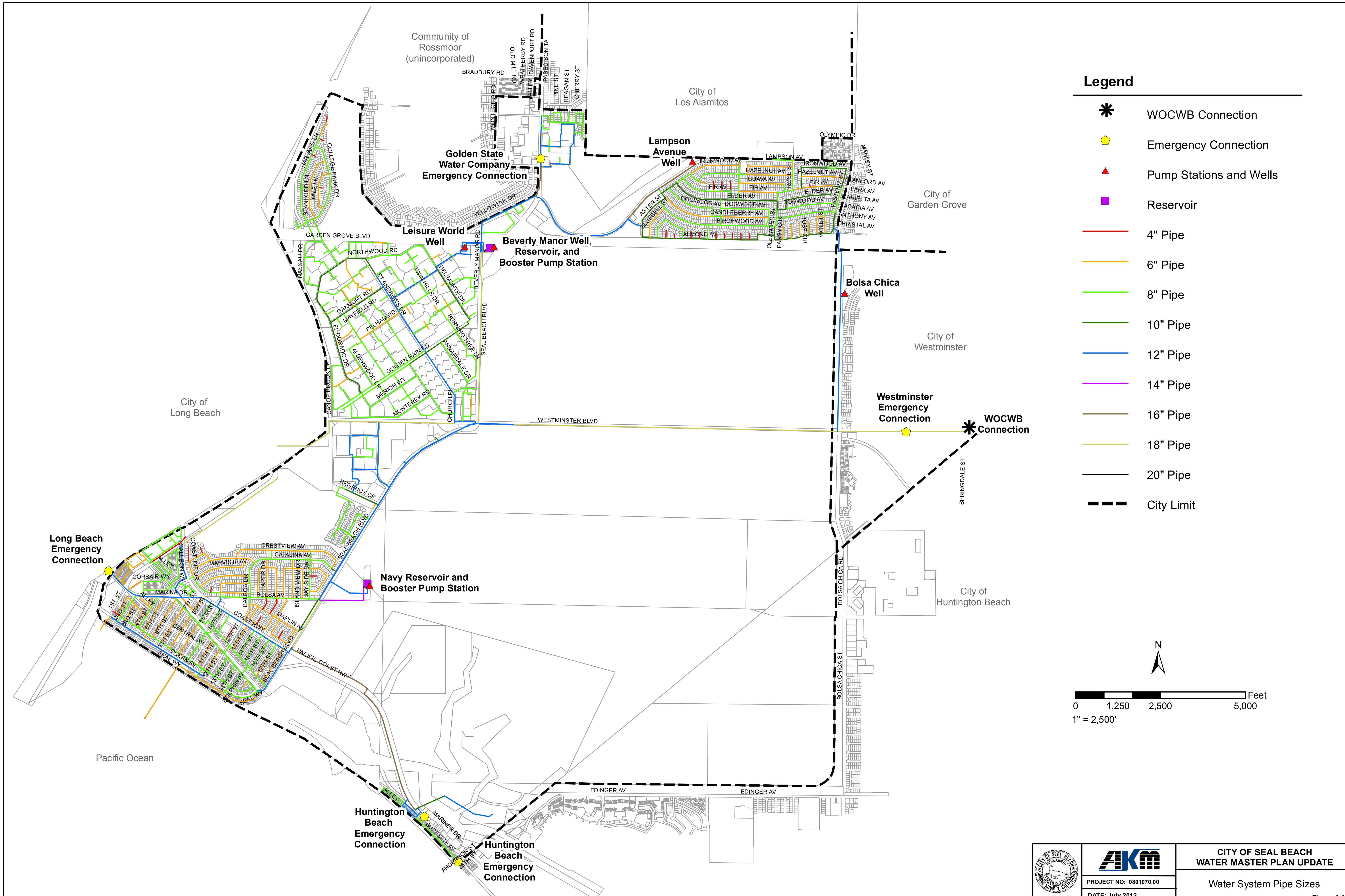
6-3 Transmission and Distribution System

The potable water system includes 387,690 feet (73.4 miles) of transmission and distribution system pipes ranging in size from 4-inches to 20-inches in diameter. Less than 2 percent of these mains are 4-inches, 20 percent are 6-inches, 38 percent are 8-inches, 8 percent are 10-inches, and 20 percent are 12-inches in diameter.

A summary of the system pipes by diameter is shown on Figure 6-2. The City's water system is illustrated by pipe diameter on Figure 6-3. Figure 6-4 and Figure 6-5 shows the pipe length constructed by decade and pipe material. The City's water pipes are detailed by the year of construction on Figure 6-6. Figure 6-7 illustrates the water pipes by material. Approximately 6 percent of the system was constructed before 1960. Approximately 55 percent of the system was installed during the 1960's, and 22 percent in the 1970's.

Figure 6-2
Length of Pipe by Size





Water System Pipe Sizes

Figure 6-3

Figure 6-4
Length of Pipe by Decade of Construction

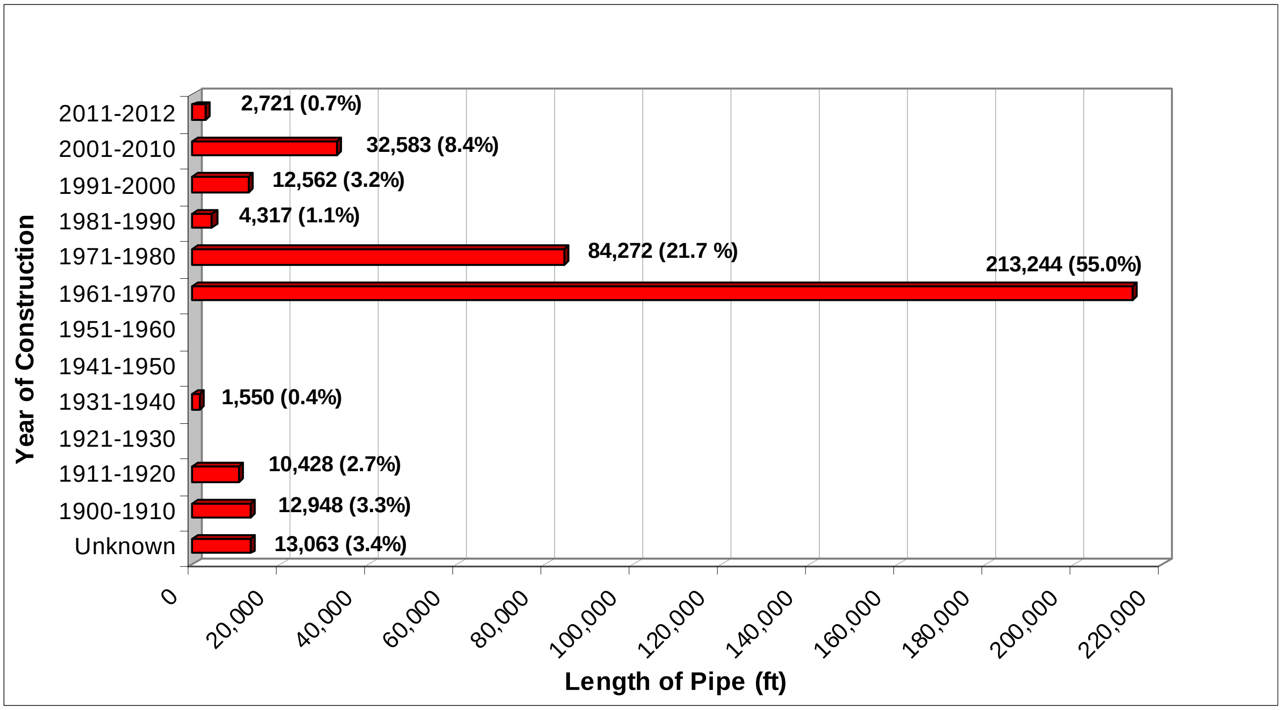
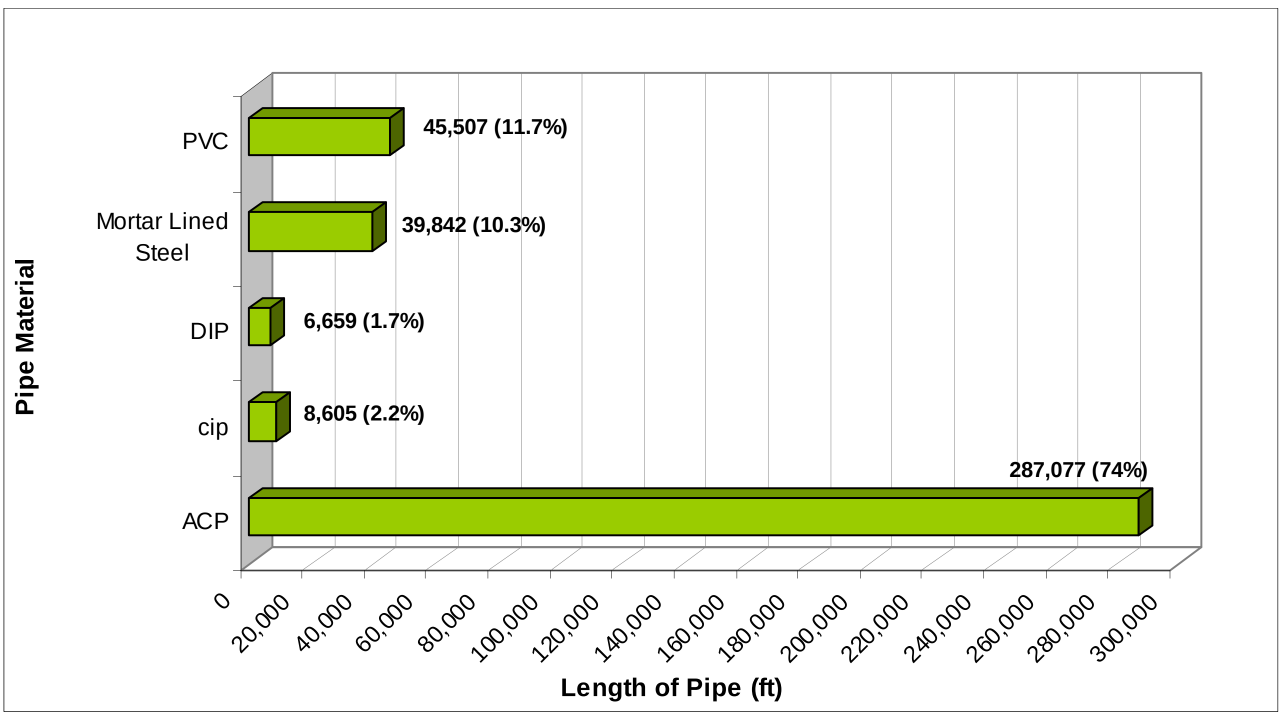
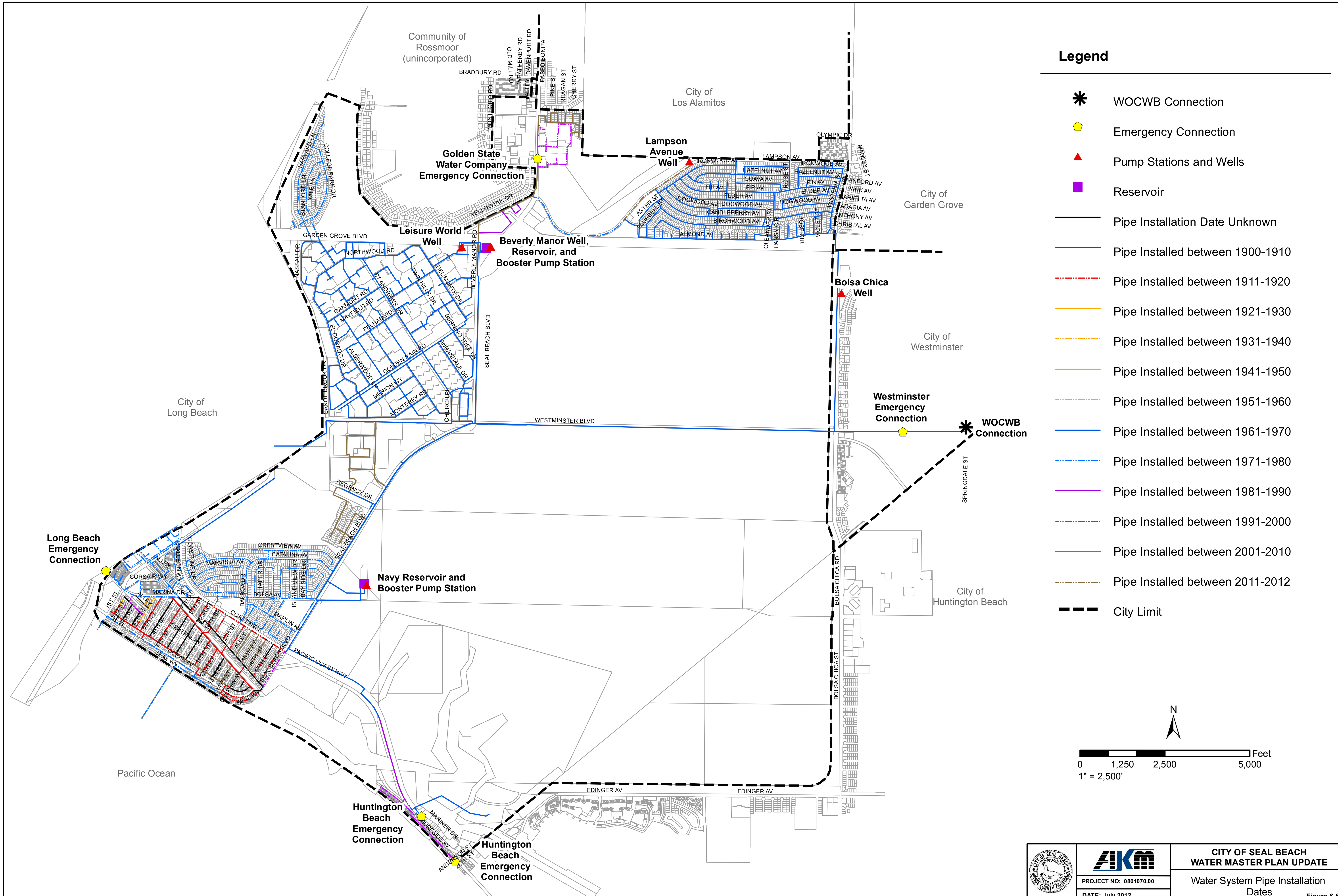
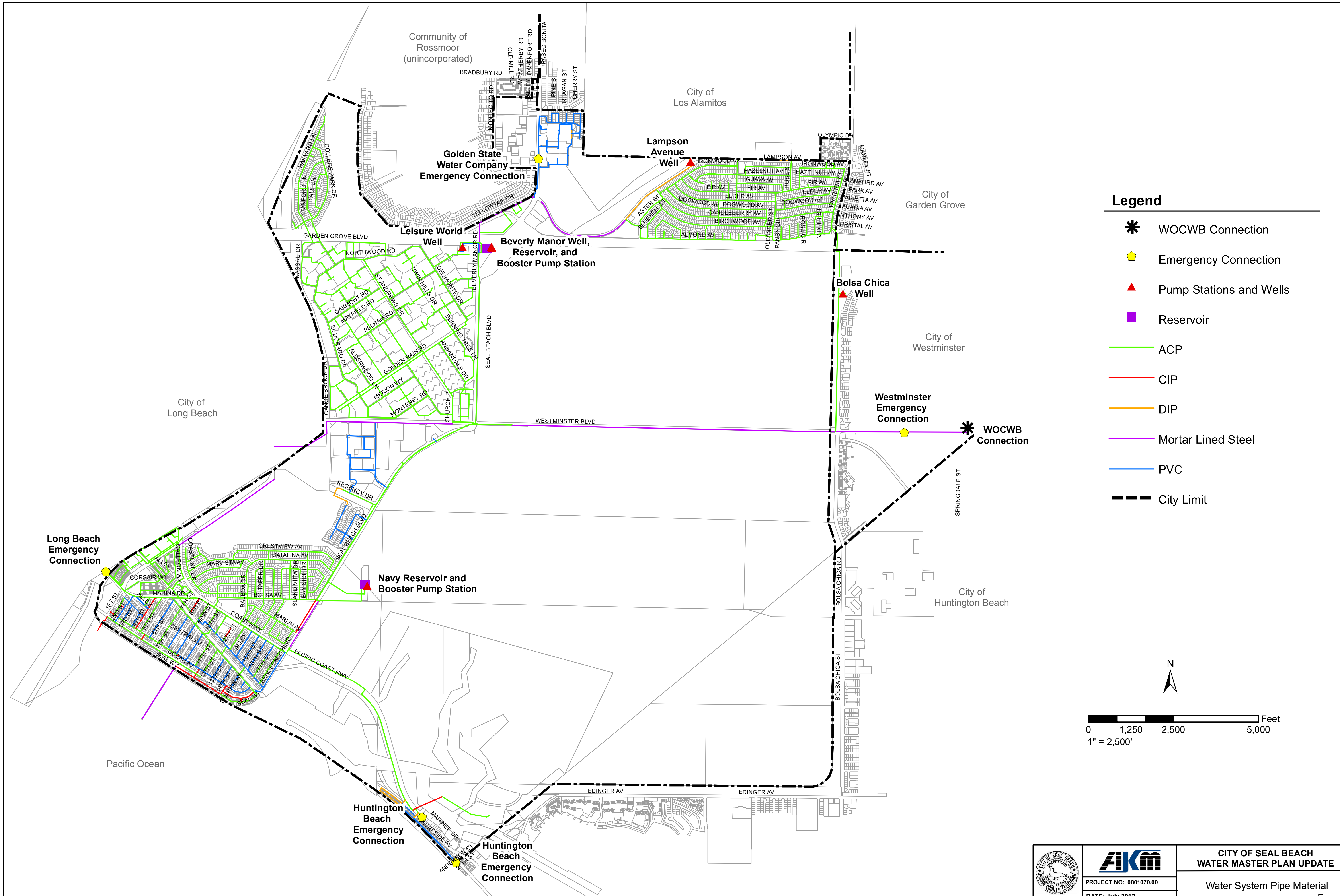


Figure 6-5
Length of Pipe by Material




Legend
WOCWB Connection
Emergency Connection
Pump Stations and Wells
Reservoir
Pipe Installation Date Unknown
Pipe Installed between 1900-1910
Pipe Installed between 1911-1920
Pipe Installed between 1921-1930
Pipe Installed between 1931-1940
Pipe Installed between 1941-1950
Pipe Installed between 1951-1960
Pipe Installed between 1961-1970
Pipe Installed between 1971-1980
Pipe Installed between 1981-1990
Pipe Installed between 1991-2000
Pipe Installed between 2001-2010
Pipe Installed between 2011-2012
City Limit
Community of Rossmoor (unincorporated)
City of Los Alamitos
City of Garden Grove
City of Westminster
City of Long Beach
City of Huntington Beach
Pacific Ocean
Golden State Water Company Emergency Connection
Lampson Avenue Well
Leisure World Well
Beverly Manor Well, Reservoir, and Booster Pump Station
Bolsa Chica Well
Westminster Emergency Connection
WOCWB Connection
Navy Reservoir and Booster Pump Station
Long Beach Emergency Connection
Huntington Beach Emergency Connection
Huntington Beach Emergency Connection
GARDEN GROVE BLVD
WESTMINSTER BLVD
SEAL BEACH BLVD
BOLSA CHICA RD
PACIFIC COAST HWY
EDINGER AV
LAMPSON AV
SPRINGDALE ST
N
Feet
0
1,250
2,500
5,000
1" = 2,500'
CITY OF SEAL BEACH
WATER MASTER PLAN UPDATE
PROJECT NO: 0801070.00
DATE: July 2012
Water System Pipe Installation Dates
Figure 6-6



Community of Rossmoor (unincorporated)
City of Los Alamitos
City of Garden Grove
City of Westminster
City of Huntington Beach
City of Long Beach
Pacific Ocean
Golden State Water Company Emergency Connection
Lampson Avenue Well
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Beverly Manor Well, Reservoir, and Booster Pump Station
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Westminster Emergency Connection
WOCWB Connection
Long Beach Emergency Connection
Navy Reservoir and Booster Pump Station
Huntington Beach Emergency Connection
Huntington Beach Emergency Connection
GARDEN GROVE BLVD
WESTMINSTER BLVD
SEAL BEACH BLVD
PACIFIC COAST HWY
EDINGER AV
BOLSA CHICA RD
BOLSA CHICA ST
SPRINGDALE ST
Legend
WOCWB Connection
Emergency Connection
Pump Stations and Wells
Reservoir
ACP
CIP
DIP
Mortar Lined Steel
PVC
City Limit
N
0
1,250
2,500
5,000
Feet
1" = 2,500'
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CITY OF SEAL BEACH
WATER MASTER PLAN UPDATE
Water System Pipe Material
Figure 6-7

6-4 Emergency Connections

The City has emergency connections with the following agencies:

- City of Long Beach, near Marina Drive and San Gabriel River
- City of Huntington Beach, near Pacific Coast Highway and Mariners Drive
- City of Huntington Beach, near Surfside Avenue and Anderson Drive
- City of Westminster, along Westminster Boulevard, east of Bolsa Chica Street
- Golden State Water Company, near the Bixby Town Center

These emergency connections should not be relied on as primary sources of supply, but only for emergencies.

6-5 Wells

The City of Seal Beach has four (4) active wells, which pump groundwater from the Main Orange County Groundwater Basin. A summary of the existing groundwater wells and groundwater supply are provided in Table 6-3 and Table 6-4, respectively.

Table 6-3
Groundwater Wells

Well	State Well No.	Well Subtype	Well Status	Date Drilled	Bore Depth (ft)	Lithlog	Elog	Ground Elevation (ft, amsl)	Cased Depth (ft)	Perforations (ft)	
						Y/N	Y/N			Top	Bottom
Bolsa Chica	05S/11W-05H01	Single Casing	Active	1/14/77	1050	Y	Y	21	1040	370	1020
Beverly Manor	05S/12W-01A04	Single Casing	Active	11/27/68	920	Y	N	11.2	900	420	900
Leisure World	05S/12W-01A03	Single Casing	Active	4/7/62	840	Y	N	9.8	840	420	840
Lamspon Avenue	04S/11W-32L01	Single Casing	Active	9/20/08	1200	Y	Y	22	1200	360	1200

Table 6-4
Existing Groundwater Supply Sources

Source	Type	Pump Stages	Design Capacity	Design TDH (ft)	Disinfection	Driver	
Bolsa Chica Well	Local	5	3,000 gpm (4.32 mgd)	300	On-site Sodium Hypochlorite Generator	400 HP Electric Motor w/Variable Speed Drive	525 HP Natural Gas Engine
Beverly Manor Well	Local	4	2,100 gpm (3.02 mgd)	252	On-site Sodium Hypochlorite Generator	N/A	100 HP Natural Gas Engine
Leisure World Well	Local	3	3,600 gpm (5.18 mgd)	153	Sodium Hypochlorite Generator at Beverly Manor Booster Station	250 HP Electric Motor	N/A
Lampson Avenue Well	Local	4	3,000 gpm (4.32 mgd)	512	On-site Sodium Hypochlorite Generator at Lampson Avenue Station	500 HP Electric Motor w/Variable Speed Drive	N/A

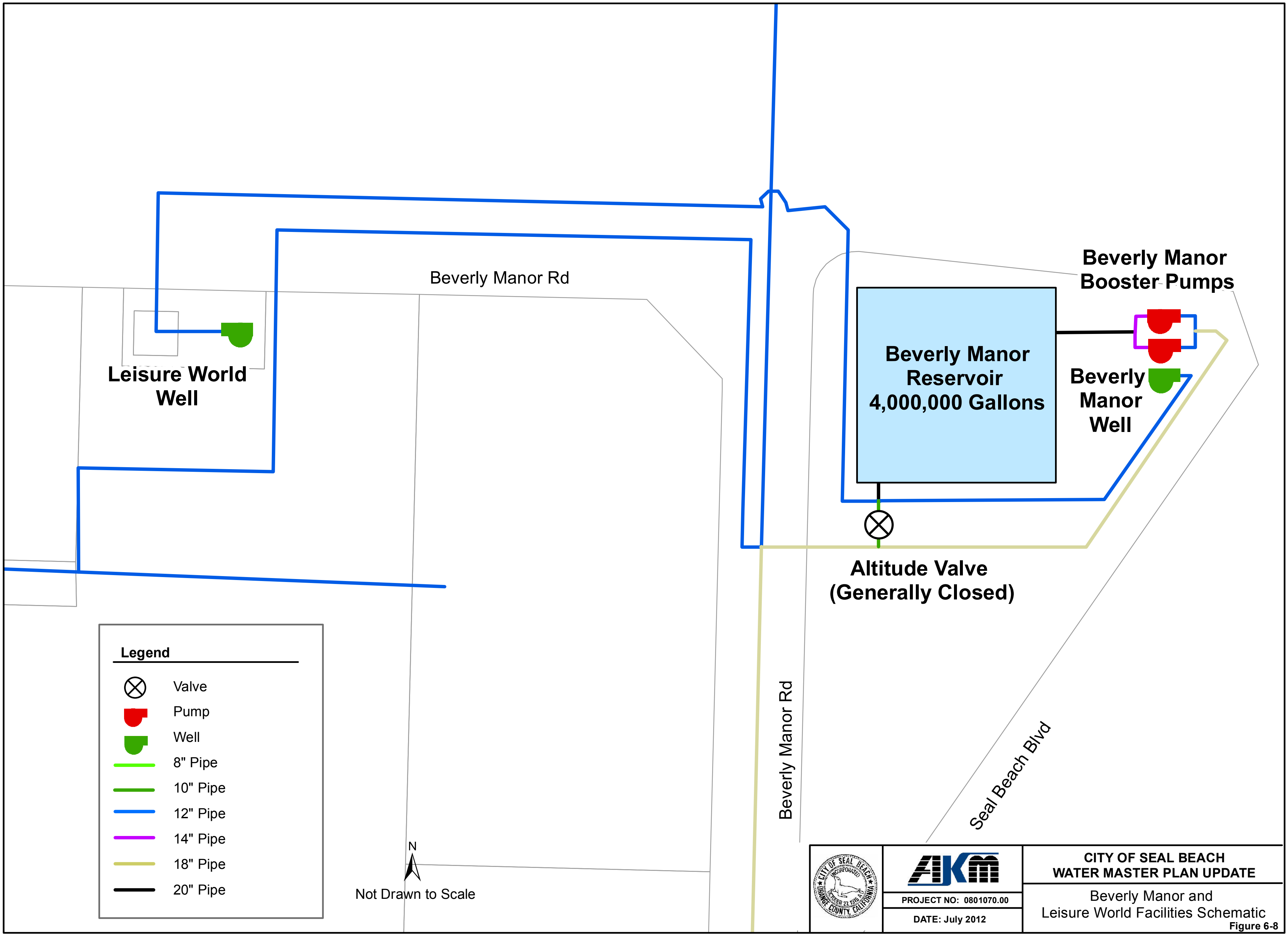
Beverly Manor Well – This well was constructed in 1969 and is located west of Seal Beach Boulevard and south of the 405 Freeway. It is currently housed in the same building as the Beverly Manor Booster Pump Station. In July 2011, the static groundwater level was 39 feet below the ground surface.

Photograph 6-1 Beverly Manor Well

The current well pump is driven by a 100 HP natural gas engine. The general layout of the Beverly Manor and Leisure World facilities is detailed on Figure 6-8. Beverly Manor Well pumps directly into the Beverly Manor Reservoir through a 12-inch ACP, which runs south on the east side of the reservoir then west on the south side of the reservoir to the flanged cross, and then north to the southwest corner of the reservoir. The well pump is a four stage Ingersoll Rand four- stage pump with a capacity of 2,100 gpm at 252 feet total dynamic head (TDH). Photograph 6-1 shows the existing Beverly Manor Well facility.

The City currently operates the Beverly Manor Well and Leisure World Well to maintain a water level of 9-feet to 11-feet in the Beverly Manor Forebay Reservoir.

The City will be constructing improvements at the Beverly Manor facility. In addition to the electrical and SCADA improvements, the City plans to remove and replace the existing well pump and gas engine. The capacity of the proposed vertical turbine pump is 2,000.



CITY OF SEAL BEACH
WATER MASTER PLAN UPDATE

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DATE: July 2012

Beverly Manor and Leisure World Facilities Schematic

Figure 6-8

gpm at 180-feet TDH. Operated by a 150 HP VFD driven motor and 350 KW natural gas emergency generator as part of the facility improvements.

Bolsa Chica Well – This well, which was constructed in 1979, is located between Bolsa Chica Road and Bolsa Chica Channel south of the 405 Freeway. Structural and electrical upgrades were completed in 1985. The static groundwater level was 53 feet in July 2011.

The existing 5-stage Flowserve well pump has 3,000 gpm capacity at 300-feet TDH. The well pump can be driven by a Toshiba Tozvert 400 HP variable frequency drive operated electric motor, as well as a 525 HP natural gas engine. According to City staff, the well is primarily operated with the electric motor. At minimum, the gas engine is tested quarterly. Pump efficiency tests were performed on December 15, 2008 and December 23, 2009. The results are shown in Table 6-5. In general, the efficiency tests were representative of the original pump curve, which was used in the hydraulic model.

Table 6-5
Bolsa Chica Well Efficiency Results

Test Date	Test No.	Measured Flowrate (gpm)	Measured Total Head (feet)	RPM (%)	Overall Plan Efficiency (%)
12/15/08	1	1,214	267	72.0%	64.6
	2	1,540	281	76.0%	71.5
	3	1,815	289	80.0%	72.6
12/23/09	1	1,050	258	70.0%	59.5
	2	1,234	266	73.0%	61.4
	3	1,501	274	76.5%	64.9

The well pump was last replaced in the spring of 2002. The inverter duty electric motor was installed in 1995. It should be planned for replacement since it is near the end of its useful life. The natural gas engine was rebuilt in the fall of 2005.

The well discharges directly to the distribution system. The Bolsa Chica Well facility is shown on Photograph 6-2.

Currently the City is having minor issues with the landline signal at the well site. The City is currently in the design stages of converting its existing landline emergency communication system to an antenna and radio SCADA system.

The City does not currently experience any groundwater quality issues at Bolsa Chica Well.

Photograph 6-2 Bolsa Chica Well

Leisure World Well – Placed in operation in 1962, the Leisure World Well is located behind a fenced enclosure in the Leisure World community, south of Beverly Manor Road. In July 2011, the static groundwater level was recorded as 40 feet. The well pump is a three stage Ingersoll Rand three-stage pump with a capacity of 3,600 gpm at 153 feet TDH. It is equipped with a 250 HP electric motor. The pump and motor are approximately 15 years old, and are nearing the end of their useful lives.

Pump efficiency tests were performed on January 15, 2008 and January 23, 2009. The results are detailed in Table 6-6, and are generally representative of the original pump curve, which is used for modeling purposes.

The general layout of the Beverly Manor and Leisure World facilities is detailed on Figure 6-8. A 12-inch ACP extends from Leisure World Well and continues easterly on Beverly Manor Road and southerly on Beverly Manor Road. The 12-inch pipe is reduced to 8-inch before connecting to a pressure reducing valve and a flanged cross, which conveys water to the southwest corner of the Beverly Manor Forebay Reservoir. The Leisure World Well site is shown on Photograph 6-3.

Table 6-6
Leisure World Well Efficiency Results

Test Date	Test No.	Measured Flowrate (gpm)	Measured Total Head (feet)	Overall Plan Efficiency (%)
12/15/08	1	1,988	221	58.9
	2	1,725	230	54.4
12/23/09	1	1,960	215	57
	2	1,600	241	51.5

The City currently operates Beverly Manor Well and Leisure World Well to maintain a water level of 9-feet to 11-feet in the Beverly Manor Forebay Reservoir.

The groundwater is passed through a sand separator before being discharged to the Beverly Manor Forebay Reservoir. The facility has experienced minor vibration issues for the past several years.

Photograph 6-3 Leisure World Well

The groundwater produced at Leisure World Well experiences color, taste, and odor issues due to hydrogen sulfide. These aesthetic issues are addressed at the Beverly Manor Forebay Reservoir, where the groundwater is treated with chlorine, aerated as it enters the reservoir and blended with water from the Beverly Manor Well. Since Lampson Avenue Well was placed into service in 2011, the City does not operate Leisure World Well as frequently as it did in the past.

The Leisure World Well discharge piping is approximately 50 years old. It should be planned for replacement as it is near the end of its useful life.

Photograph 6-4 Lampson Avenue Well

Lampson Avenue Well – Lampson Avenue Well was placed into operation in 2011. It is located north of Lampson Avenue, east of the Old Ranch Golf Course and south of the Los Alamitos Joint Forces Training Center. The static groundwater level was 40 feet below the ground surface in July 2011.

Photograph 6-4 shows the existing Lampson Avenue Well facility. The well pump is a four-stage Flowserve pump with a capacity of 3,000 gpm at 512-feet TDH. It is equipped with a 500 HP variable frequency drive operated electric motor.

Lampson Avenue Well pumps directly into the distribution system through a 16-inch steel pipe that runs southeast of the pump station to the 16-inch DIP in Lampson Avenue. The 16-inch pipe extends southwest on Lampson Avenue to Basswood Street. To loop the distribution system near the well and to provide additional redundancy, it is recommended that the City construct the following:

- 12-inch DIP on Lampson Avenue between Lampson Avenue Well and Heather Street
- 8-inch DIP on Lampson Avenue, between Heather Street and 8-inch DIP that terminates at 4665 Lampson Avenue

This site does not currently have a backup power supply in the event of an emergency. It is recommended that the City install an emergency diesel generator.

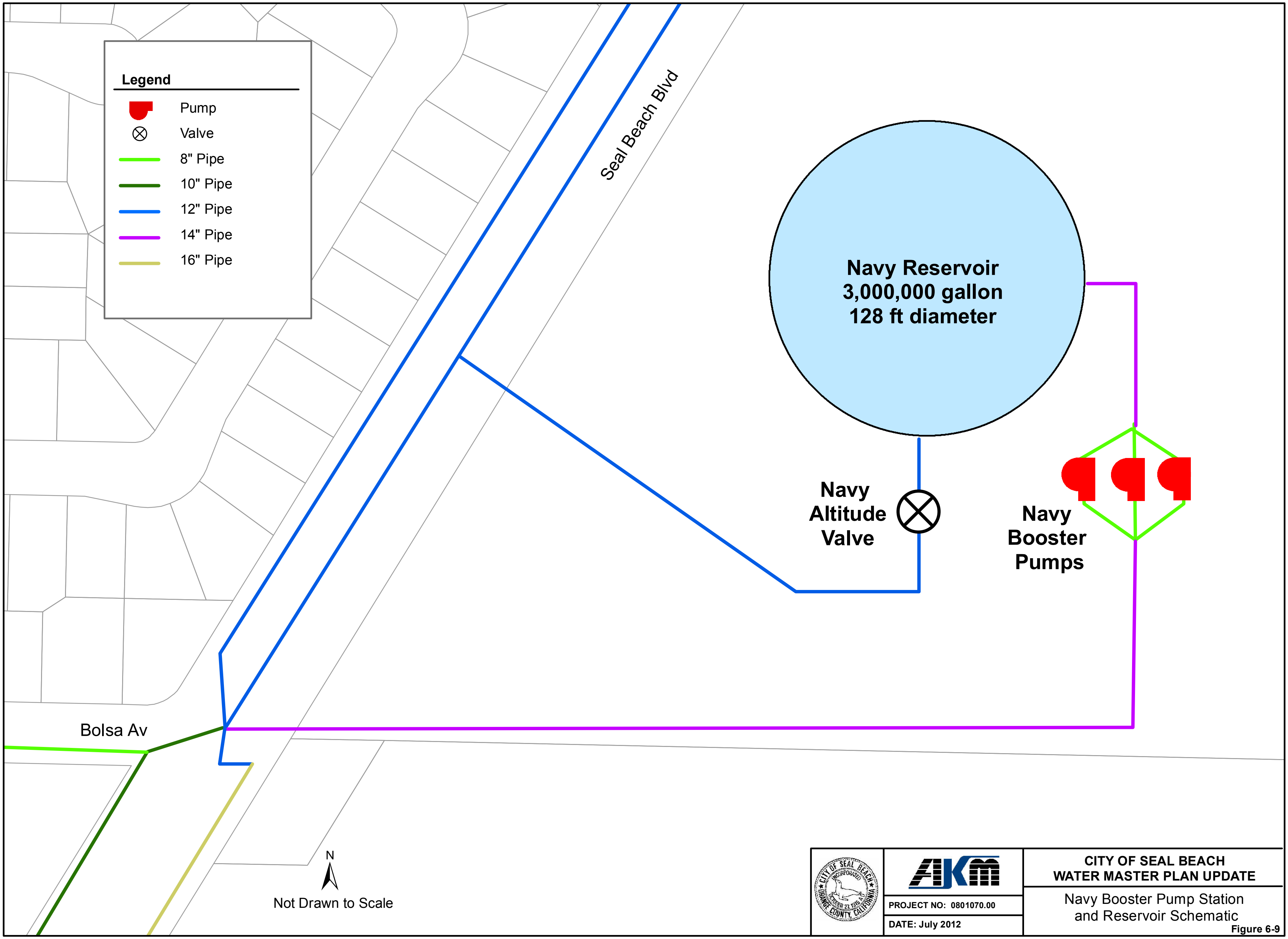
6-6 Booster Pump Stations

The City's water system relies greatly on its two existing booster pump stations to provide adequate system pressures. The two storage reservoirs act as forebay storage to the booster pump stations.

Navy Booster Station – The Navy Booster Station was constructed in 1963. The pump station and reservoir are located within the U.S. Naval Weapons Station, east of Seal Beach Boulevard and north of Bolsa Avenue.

Improvements to the Navy Booster pump station were completed in 2006 and included building replacements, pump replacement, piping modifications, and electrical updates. As part of the improvements completed in 2007, the old control panel and pump controller unit were replaced. Navy Booster Pump Station is shown on Photograph 6-5.

The Navy Booster Station pressurizes the distribution system in the Old Town and Marina Hill communities during high demand periods. The general layout of the Navy Booster Pump Station and Reservoir is detailed on Figure 6-9. It takes suction from the east side of the Navy Reservoir. A 14-inch suction header conveys the water south to the pump station, which has three (3) horizontal split-case single stage Peerless pumps. Each pump has a design capacity of 1,400 gpm at 140 feet TDH. They are driven by 75 HP electric motors


Legend
Pump
Valve
8" Pipe
10" Pipe
12" Pipe
14" Pipe
16" Pipe
Seal Beach Blvd
Navy Reservoir
3,000,000 gallon
128 ft diameter
Navy
Altitude
Valve
Navy
Booster
Pumps
Bolsa Av
N
Not Drawn to Scale
PROJECT NO: 0801070.00
DATE: July 2012
CITY OF SEAL BEACH
WATER MASTER PLAN UPDATE
Navy Booster Pump Station
and Reservoir Schematic
Figure 6-9

operated by VFD. Pump efficiency tests conducted on December 15, 2008 are detailed in Table 6-7 In general, the efficiency tests were representative of the original pump curve, which was included in the hydraulic model.

Table 6-7
Navy Booster Well Efficiency Results

Test Date	Test No.	Measured Flowrate (gpm)	Measured Total Head (feet)	RPM (%)	Overall Plan Efficiency (%)
12/15/08	1	412	118	75.5%	44.7
	2	1,370	135	99.8%	61.2
12/15/08	1	508	119	76.0%	52.2
	2	1,030	123	87.8%	60.2
	3	1,377	136	99.8%	60.2
12/15/08	1	584	119	78.3%	51.5
	2	970	126	87.8%	57.6
	3	1,394	134	99.8%	59.2

Beverly Manor Booster Station – Beverly Manor Booster Station is located south of the San Diego Freeway and west of Seal Beach Boulevard. It was constructed in 1969 and is located in the same structure as the Beverly Manor Well. The general layout of the Beverly Manor and Leisure World facilities is detailed on Figure 6-8. Currently, it contains two natural gas engine driven Johnson vertical turbine pumps, each with a capacity of 2,000 gpm at 162 feet TDH. The two booster pumps are located to the northeast of the Beverly Manor well pump. The suction header is a 20-inch steel pipe and extends from the bottom of the northeast corner of the Beverly Manor Reservoir to the pump station facility. From the booster pump station, an 18-inch discharge pipe conveys the water south and west to Seal Beach Boulevard and into the distribution system. Photograph 6-6 shows the two booster pumps at the Beverly Manor Booster Station.

The City will be constructing improvements to the Beverly Manor Pump Station, which will include new pumps, discharge piping, a 350 KW emergency natural gas generator, and two (2) 75 HP VFD operated electric motors, a motor control center, and electrical controls.

Photograph 6-5 Navy Booster Pump Station

Photograph 6-6 Beverly Manor Booster Pump Station

6-7 Reservoirs

The City of Seal Beach owns two forebay reservoirs with a total capacity of 7 MG and a usable capacity of 6.3 MG.

Photograph 6-7 Navy Reservoir

Navy Reservoir – The Navy Reservoir is an above ground steel structure that was constructed in 1963. It is located within the U.S. Naval Weapon Station, to the west of Seal Beach Boulevard and north of Bolsa Avenue. It is 128 feet in diameter, and 32 feet in height, with a total capacity of 3 MG and a maximum usable storage capacity of 2.5 MG. Photograph 6-7 shows the existing reservoir.

Navy Reservoir acts as forebay for the Navy Booster Station, and as terminal storage for the imported water supply when it is used. Improvements to the inlet piping were completed in 2009. The general layout of the Navy Booster Pump Station and Reservoir is detailed on Figure 6-9. The distribution system generally supplies the reservoir during the low demand periods through a 12-inch ACP that extends east from Seal Beach Boulevard to a 12-inch altitude valve for one way flow. The 12-inch pipe is increased to 14-inch before entering the south side of the reservoir. Inside the reservoir, the 14-inch pipe extends 30-feet vertically. This pipe is configured with ten (10) 4-inch half coupling nozzles that are generally evenly spaced which allow for better circulation in the reservoir.

Currently, the altitude valve is used to regulate the flow into the Navy Reservoir. The City sets this valve to open when the distribution system pressures are between 58 psi and 62 psi.

Photograph 6-8 Beverly Manor Forebay Reservoir

Beverly Manor Reservoir – This concrete reservoir was constructed in 1969 and has a total volume of 4.0 MG. The usable storage is 3.8 MG. It is a below ground facility with a 182 ft square bottom, 1:1 side slopes, and 14.5 feet depth. Photograph 6-8 shows the Beverly Manor Reservoir. It is located south of the San Diego Freeway and east of Seal Beach Boulevard. The forebay reservoir is located to the west of the Beverly Manor Well and Booster Station. The bottom of the reservoir slopes to the southwest, where an 8-inch floor drain may be used to convey the water northwest to a 39-inch storm drain located in Seal Beach Boulevard. A 16-inch overflow pipe is also located on the southwest corner of the reservoir, and it also drains to the Seal Beach Boulevard storm drain during an overflow.

The Beverly Manor Forebay Reservoir generally stores the groundwater pumped from Leisure World Well and Beverly Manor Well, and acts as forebay for the Beverly Manor Booster Station. The general layout of the Beverly Manor and Leisure World facilities is detailed on Figure 6-8. On the southwest side of the reservoir, there is a flanged cross which can convey groundwater from Beverly Manor Well and Leisure World Well and the water from distribution system to the Beverly Manor Reservoir. The inlet pipe into the reservoir is a 20-inch steel pipe. Typically, the reservoir is filled by the Beverly Manor Well, the Leisure World Well or both.

It is recommended that the City install an additional access hatch and a ladder near the inlet pipe on the south west side of the reservoir when the improvements at the Beverly Manor Well and Pump Station are implemented.

6-8 Supervisory Control and Data Acquisition (SCADA) System

Portions of the City's water system is managed and monitored at the SCADA base station at the City's Adolfo Lopez Corporate yard. The City's existing SCADA and telemetry capacities are detailed in the Table 6-8.

Table 6-8
Existing SCADA / Telemetry Capacities

Bolsa Chica Well	
Flow	Circle Chart Recorder
Discharge Pressure	Circle Chart Recorder
CL2 Residual	Circle Chart Recorder
Lampson Avenue Well	
Flow	Circle Chart Recorder
Discharge Pressure	Circle Chart Recorder
CL2 Residual	Circle Chart Recorder
Discharge Pressure	SCADA
Discharge Flowrate	SCADA
Groundwater Level	SCADA
CL2 Residual	SCADA
CL2 Level	SCADA
Pump Speed	SCADA
Beverly Manor Well	
Flow	Circle Chart Recorder
CL2 Residual	Circle Chart Recorder
Beverly Manor Pump Station	
Flow	Circle Chart Recorder
Discharge Pressure	Circle Chart Recorder
Leisure World Well	
Flow	Circle Chart Recorder

Beverly Manor Reservoir	
Reservoir Level	Circle Chart Recorder
Navy Booster Pump Station	
Flow	Circle Chart Recorder
Discharge Pressure	Circle Chart Recorder
CL2 Residual	Circle Chart Recorder
Flow	SCADA
Discharge Pressure	SCADA
CL2 Residual	SCADA
CL2 Tank Level	SCADA
Pump Speeds (1-3)	SCADA
Pump ETM (1-3)	SCADA
Navy Reservoir	
Reservoir Level	SCADA
Leisure World North Connection	
Flow	SCADA
Pressure	SCADA
Leisure World Post Office South Connection	
Flow	SCADA
Pressure	SCADA

The City is in the process of providing improvements at the Beverly Manor facility. Along with the mechanical, electrical and structural improvements, the City plans to integrate Beverly Manor Well and Beverly Manor Booster Pump Station into the existing digital signal transmission SCADA system. SCADA Improvements at Bolsa Chica Well are also in the design stages. Leisure World Well should also be incorporated into the existing SCADA system to provide the City complete remote control of its water systems facilities data.

6-9 Disinfection Facilities

Navy Reservoir and Booster Pump Station – The old corrugated steel chlorine building was replaced with a premanufactured fiberglass reinforced plastic (FRP) building during the Navy Booster Pump Station improvements in 2006. An on-site sodium hypochlorite (salt-based) generation facility feeds the disinfectant to the outlet of the Navy Forebay Reservoir by means of a metering pump. The Schedule 80 PVC feed pipe is below ground where it connects to the reservoir outlet pipe. Currently the City has been experiencing problems with its Severn Trent chlorine controller. The City should look into replacing this equipment if it cannot be repaired.

Photograph 6-9 Bolsa Chica Well Chlorination Room

Bolsa Chica Well Disinfection Facility– The disinfection facility at the Bolsa Chica Well site is located inside the building enclosure. The 75 pound per day salt-based system generates sodium hypochlorite on-site and is equipped with a 1,600 gallon tank. The solution is pumped to the well discharge line. The system is shown on Photograph 6-9.

Leisure World Well Site – Leisure World Well had a chlorine gas-based disinfection system at the wellhead. This system has been inactive, and the groundwater production of the well is disinfected as it enters the Beverly Manor Reservoir. The old chlorination building is currently used for storage. The City plans to remove and replace the existing chlorine system that serves the Beverly Manor Reservoir inlet with a new 200 pounds per day onsite sodium hypochlorite system, when improvements are made at the Beverly Manor facility.

Photograph 6-10
Beverly Manor Well Chlorination Room

Beverly Manor Well Site – The well outlet is currently disinfected by an on-site sodium hypochlorite generator with a capacity of 150 pounds per day, as shown on Photograph 6-10. The system is used to disinfect the groundwater from the Beverly Manor Well and the effluent from Beverly Manor Reservoir. Currently one of the sodium hypochlorite storage tanks experiences minor leaks when the tank level is too high. Also, the existing large chlorine injector is made of scheduled 80 PVC, which is experiencing breaks due to old age. The City plans to remove and replace the existing generator with a new 200 pounds per day onsite sodium hypochlorite generator, when improvements are made at the Beverly Manor facility. New sodium hypochlorite storage tanks and a new chlorine injection line to the booster pump station discharge pipe will also be installed during the Beverly Manor facility improvements.

Lampson Avenue Well Site - The chlorine room at the Lampson Avenue Well site is located to the south of the well pump, and consists of a 200 pounds per day sodium hypochlorite generator. This system is shown on Photograph 6-11.

Photograph 6-11
Lampson Avenue Well Chlorination Room

SECTION 7

SERVICE CRITERIA

7-1 General

Performance criteria are established to evaluate the adequacy of various water system components through a systematic analysis, and to identify necessary improvements to the system for inclusion in a Capital Improvement Program (CIP). Some criteria, such as service pressures, storage capacity, and sources of supply are based upon experience and their application is at the discretion of the water purveyor. For the City, these criteria are generally in accordance with the California Code of Regulations, Title 22. This includes service pressures, storage capacity, and sources of supply. Other criteria, such as water quality and fire protection, are based on federal, state and local jurisdictional requirements.

This section details the criteria which will serve as a benchmark for evaluating the City's water system. A summary of the service criteria for Seal Beach's system is listed in Table 7-1.

Table 7-1
Service Criteria

Description	Criteria	Existing Requirement
1. Source of Supply		
a. Total	Maximum Day Demand	4,120 gpm (5.93 mgd)
b. Local Supply	Average Day Demand	2,169 gpm (3.12 mgd)
2. Reservoir Capacity		
a. Operational Storage	35% of Maximum Day Demand (includes an increase of 15% for submergence over the reservoir outlet pipe)	2.38 MG
b. Emergency Storage	Seventy Percent of Seven (7) Average Day Demand less local groundwater well capacity	N.A.
c. Fire Suppression	Includes an increase of 15% for submergence over the reservoir outlet pipe	
Single Family Residential	2,000 gpm for 2 hours (plus 15%)	0.28 MG
Multi-Family Residential	3,000 gpm for 4 hours (plus 15%)	0.83 MG
Schools	3,500 gpm for 4 hours (plus 15%)	0.97 MG
Commercial / Industrial	4,000 gpm for 4 hours (plus 15%)	1.10 MG
3. Booster Pump Stations	Firm Capacity including well capacity directly pumped into the system, must deliver Maximum Day Demand plus Fire Flow Demand or Peak Hour Demand, whichever is greater	
	Stand-by pump equal in size to the largest duty pump	
	Flow meters, suction and discharge pressure gauges, and telemetry equipment for alarm and status notification at each station	
	Provisions for emergency power at all stations	

Description	Criteria	Existing Requirement
4. Minimum Pipe Size	6-inch	
5. Maximum Velocities	6 fps at peak flows (5 fps for PVC)	
	10 fps at Fire Flow Demand	
6. Static Pressures	Minimum 50 psi	
	Desired 60-80 psi	
	Maximum 100 psi	
7. Dynamic Pressures	Minimum 40 psi during Maximum Day Demand	
8. Fire Flow Demands		
a. Single Family Residential	2,000 gpm for 2 hours with 20 psi residual pressure at fire hydrant	0.24 MG
b. Multi-Family Residential	3,000 gpm for 4 hours with 20 psi residual pressure at fire hydrant	0.72 MG
c. Schools	3,500 gpm for 4 hours with 20 psi residual pressure at fire hydrant	0.84 MG
d. Commercial / Industrial	4,000 gpm for 4 hours with 20 psi residual pressure at fire hydrant	0.96 MG

7-2 Source of Supply

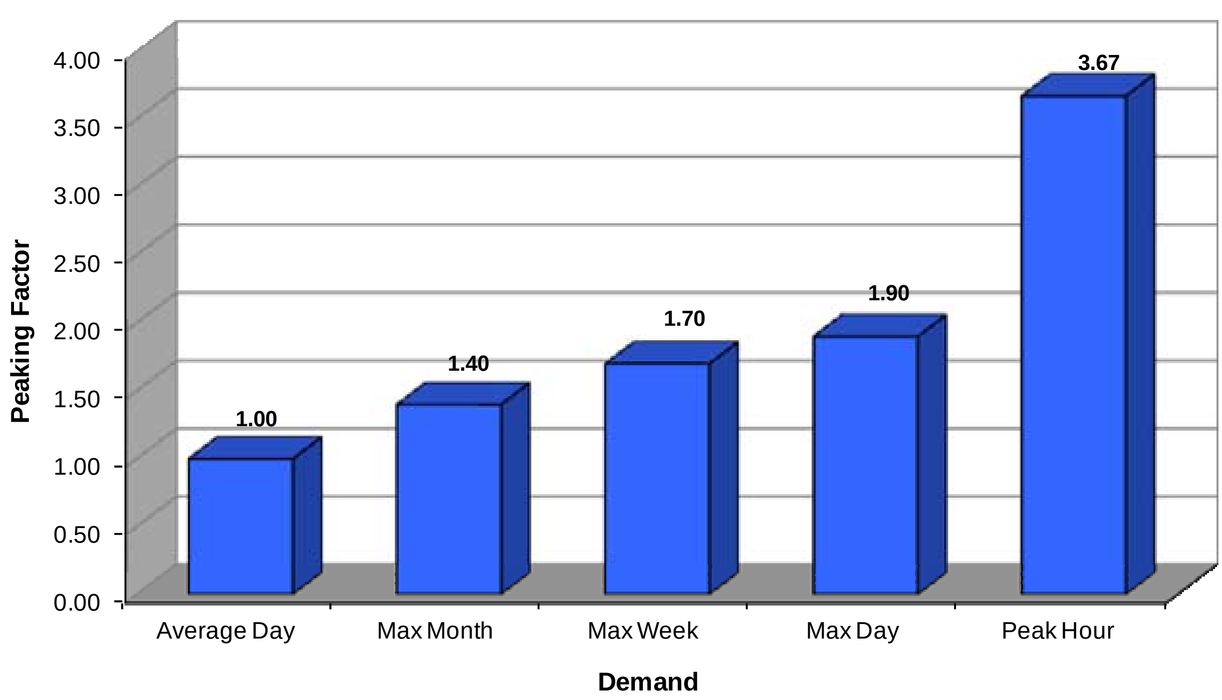
Any water system should be capable of meeting all demands imposed upon the system. This can be achieved through multiple supply sources, storage, or a combination of both. Generally, the determination is based upon supply availability, existing storage capacity, and economics. It is prudent to secure water supplies from multiple sources so that demands can be met at reasonable levels when one or more water sources are not available.

The criterion for source of supply (total production and purchase) adopted by most water agencies is to maintain one maximum day demand (4,120 gpm for Seal Beach). Under this criterion, reservoir storage is typically needed to regulate hourly fluctuations in demand, provide for fire flow storage and or outage of a source of supply for an extended duration.

7-3 Peaking Factors

It is important to evaluate a water system during various incremental peak demands. Typically, a water system is designed to meet the maximum demands placed on it. The system components must be designed to cope with these demands as they occur. Maximum month and maximum day demands are important factors in sizing a system's supply capability. Maximum day demands usually dictate the design criteria for both system transmission and storage needs. Peak hour criterion is a measure of the system's overall adequacy with respect to its transmission and distribution elements. The City of Seal Beach's peaking factors utilized in this study are shown on Figure 7-1.

Figure 7-1
Peaking Factors



7-4 Storage

For a water system such as the City's three (3) categories of storage are of importance: fire suppression, operational, and emergency.

Fire Suppression Storage

Fire suppression storage is the volume required to supply the service area with the minimum fire flows established by the Orange County Fire Authority. These guidelines range from 2,000 to 4,000 gpm for a duration of two (2) to four (4) hours. To deliver the maximum fire flow of 4,000 gpm for 4 hours, a storage volume of 0.96 million gallons (MG) is required.

The required fire suppression storage has been increased by 15 percent to 1.10 MG (1.15 x 0.96 MG) to account for the necessary submergence over the reservoir outlet pipe.

Operational Storage

Operational Storage serves to equalize variations in sources of supply and demand over short periods of time (daily or weekly) and to fight fires. Utilizing the daily demand hydrograph, the component of operational storage needs to account for the difference in supply and demand, which can be determined with an extended period simulation of the system over a day, or week, etc.

The operational storage might typically be based on one maximum day demand if groundwater storage is not available. For the City of Seal Beach's system, the operational storage criterion is based on 35 percent of the maximum day demand (0.35 x 5.93 MG = 2.08 MG).

The required operational storage has been increased 15 percent to 2.39 MG (1.15 x 2.08 MG) to account for the necessary submergence over the reservoir outlet pipe.

Emergency Storage

Emergency storage is used in the event of an interruption in the primary water supply source. It is assumed that most outages can be mitigated within 7 days. Accordingly, many agencies that depend solely on imported water utilize 7 average days of storage as their emergency storage criterion. It is reasonable to expect that groundwater sources will be available during an outage of the imported water supply. Therefore, the required emergency storage volumes may typically be reduced by an agency's groundwater supply capacity. The City of Seal Beach's emergency storage volume can be reduced by the actual production capacity of its wells. The only requirement would be that the facilities be capable of pumping the water needed during an emergency from the wells. Since the City's well capacity exceeds the existing average day demand (2,169 gpm) and the maximum day demand (4,120 gpm), the City's system does not require emergency storage.

Total Storage

The total storage requirement for the City's system is summarized below:

Fire Suppression	1.10 MG
Operational	2.38 MG
Emergency (Available from Groundwater)	0 MG
Total	**3.48 MG**

The City has 6.3 MG of usable storage, which exceeds the required storage.

7-5 Wells

The City of Seal Beach has four (4) active wells. Any new wells should be designed in accordance with the Water Well Standards: State of California Bulletin 74-81, the American Water Works Association (AWWA) standards, California Department of Public Health requirements, and sound engineering judgment. The pumps should be placed low enough so that subsequent lowering should not be necessary. If at all possible, well screens should be below the pump suction to preclude cascading of water into the well casings. (The casings should be large enough to maintain a velocity of less than 0.1 foot per second at the maximum anticipated flow.) Additionally, the casings diameters should be selected to allow lining the wells in the future without loosing capacity. The use of higher grade materials, such as stainless steel should be considered to increase the useful life of all future wells.

The well design should include a 4-inch diameter camera tube extending to below the pump suction elevation, and a sounding tube. A separate air line with a depth gauge and an air connection or depth to water transducer should be provided at every well. Flow meters, pressure gauges, transducers, and telemetry equipment should be included to continuously monitor the wells. Permanent emergency generators with automatic transfer switches should be provided at each future well site. Soft start bypass should be provided for each variable frequency drive so that a pump can be operated when its VFD is out of service.

7-6 Booster Pump Stations

Booster pump stations are some of the most critical facilities in the City's water distribution system. The Beverly Manor Booster Pump Station and the Navy Booster Pump Station, along with Bolsa Chica Well and Lampson Avenue Well deliver water into the City's system. As such, their reliability is of utmost importance to the system.

All future booster pump stations should incorporate a standby pump of the same size as the largest duty pump. This ensures that there is a replacement for the largest duty pump during maximum day demand conditions, while one of the pumps at the station is being repaired or replaced. It typically takes pump manufacturers 12 to 16 weeks for delivery of a new pump and motor unit once the order is placed and shop drawings are approved.

The future pump stations should be equipped with modern pump controllers, flow meters, suction and discharge pressure gauges, proper isolation valves, and telemetry equipment. Flow meters and pressure gauges are essential tools for monitoring pump performance and demand conditions in the service area. Telemetry equipment is used to remotely monitor the status of the facility, and notify personnel in the event of a failure.

Pump stations should be constructed of fireproof materials and be provided with peripheral sprinkler systems to prevent fire damage. Furthermore, power to the pump stations should be provided through underground service to minimize possibility of damage during fires. Pump stations with electric motors should be equipped with standby generators and automatic transfer switches to operate them during commercial power outages. Soft start bypass should be provided for each variable frequency drive so that a pump can be operated when its VFD is out of service.

7-7 Pressure Regulating Stations

The City's system currently does not have any pressure regulating stations. However, should they be incorporated into the system in the future, they should be constructed with sufficient valving to deliver the entire range of demands and the fire flows within their proper operating range. Wherever possible, a minimum of two pressure regulating stations should serve any sub-zones. Pressure regulating stations should be constructed with a pressure relief valve at the downstream end to preclude excessive pressures in the service area in case of malfunctioning of the pressure reducing valves. Each pressure regulating station should be equipped with flow meters and telemetry equipment so that their operation can be remotely controlled through the SCADA system.

7-8 System Pressures

Most water utilities set 50 pounds per square inch (psi) as the minimum static pressure throughout the system. The water system should also be capable of maintaining a minimum residual pressure of 40 psi during peak hour demand period.

A residual pressure of 20 psi must be maintained at the hydrant outlets in developed areas during fire flow. The hydraulic model does not include laterals from the mainline to the hydrants. It is estimated that there can be a loss of up to 6 psi through a typical lateral and hydrant at 1,000 gpm. The system evaluation is therefore based on providing 26 psi at the nearest mainline junction in the model.

Static pressures should not exceed 120 psi, except where system operating conditions and geographical conditions warrant a higher maximum pressure. In areas where pressures exceed 80 psi, the Uniform Plumbing Code requires customers to install "an approved type pressure regulator preceded by an adequate strainer" on their service connections to protect domestic plumbing and water heaters.

7-9 Transmission and Distribution Pipelines

The distribution system should be sized and designed to provide redundant service at adequate pressures for normal use as well as at fire flow conditions. In most cases, this can be accomplished by looping the system. Looping through easements or other areas which are not easily accessible should be avoided.

In order to maintain adequate system pressures and prolong the life of the pipe, flow velocities should be limited. The system should operate at velocities of 1 to 3 feet per second (fps) normally, with a maximum velocity of 6 fps at intermittent peak flows. The pipe velocity at fire flows should not exceed 10 fps.

The pressure in the system at any given point for a particular flow is dependent on a number of variables including pipe size, roughness and length. These components all contribute to the magnitude of pressure losses in the system. The system should be designed and operated to maintain system losses less 10 feet for each 1,000 feet of pipe length for distribution pipelines under Maximum Day Demand conditions under any condition, subject to satisfying all other criteria.

All pipes should be sized to provide adequate fire flows. To achieve this, when a single, unlooped pipe provides fire service to an area, a minimum diameter of 8-inch should be maintained to the last hydrant. All mains should be constructed with a minimum diameter of 8-inch, except on short cul-de-sac dead-end mains where 6-inch lines may be allowed. These pipe size recommendations should be adhered to for all new design and construction projects, as well as any waterline replacement/upgrade projects.

7-10 Service Life of Facilities

All facilities have expected useful lives for which relatively trouble-free service can be expected. Once exceeded, these facilities become less reliable, expensive to maintain and are subject to failure. Therefore, facility age is considered in the assessment of all water systems and in formulating future replacement projects.

The determination of the expected useful life is dependent upon multiple considerations. Table 7-2 details the planning criteria that is generally accepted as prudent planning criteria. These criteria should be one of the considerations in determining the phasing of facility replacement.

Table 7-2
Planning Criteria for Facility Expected Useful Life

Facility	Expected Useful Life (Years)
Steel Reservoirs	60
Concrete Reservoirs	60
Lined & Coated Ductile	75
Plastic (PVC) Pipe	75
Asbestos Cement Pipe	75
Cast Iron and Steel Pipe (Lining or coating of non-current practice)	30
Pump Stations	
Structure	60
Piping	40
Valving	20
Mechanical	15
Electrical	15

7-11 Fire Suppression

The required fire flows are based upon the City of Seal Beach's Building Code Section 9.60.005 of Municipal Code: Title 9: Public Property, Public Works and Building Regulations. The City's fire code currently adopts the California Fire Code. Table 7-3 is a reproduction of Table 105.1 of the California Fire Code. Since there are a number of land use classifications, as well as special conditions affecting the fire flow required, typical flows for modeling were selected for each land use. These selections are shown in Table 7-4.

Table 7-3
Minimum Required Fire Flow and Flow Duration for Buildings

Fire Flow Calculation Area (sq. ft.)					Fire Flow (gpm)[c]	Flow Duration (hrs)
Type IA and IB[b]	Type IIA and IIIA[b]	Type IV and V-A[b]	Type IIB and IIIB[b]	Type V-B[b]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
-	-	115,801-,125,500	83,701-90,600	51,501-55,700	6,250	
-	-	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
-	-	135,501-145,800	97,901-16,800	60,201-64,800	6,750	
-	-	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
-	-	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
-	-	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
-	-	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
-	-	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. The minimum required fire flow shall be allowed to be reduced by 25 percent for Group R

b. Types of construction are based on the California Building Code

c. Measured at 20 psi at hydrant outlet

Table 7-4
Fire Flow and Fire Hydrant Location Criteria

Land Use	Fire Flow (gpm)	Duration (hrs)	Residual Pressure at Hydrant Outlet (psi)	Average Spacing between Hydrants (ft)	Max Distance from Hydrant to any Point on Lot Frontage (ft)
Residential Single Family	2,000	2	20	450	225
Residential Multi-Family	3,000	3	20	400	225
Schools	3,500	4	20	350	210
Commercial / Industrial	4,000	4	20	350	210

The single family residential flow was set as 2,000 gpm for 2 hours. Multiple family residential fire flow was set as set at 3,000 gpm for 3 hours. Fire flow for schools was established at 3,500 gpm for 3 hours. Fire flows for commercial and industrial uses was established at 4,000 gpm for 4 hours.

Per Section B105.1 of the California Fire Code, the fire flow requirement may be reduced by 50 percent when the building is equipped with an approved automatic sprinkler system. The resulting fire flow cannot be less than 1,500 gpm. Some commercial and multiple family residential buildings may require larger fire flows than those included in this master plan, based on the building square footage. It is recommended that these facilities install automatic fire sprinklers to reduce their fire flow requirement to comply with the criteria included in this master plan.

Generally, fire hydrants must be spaced at an average of 450 feet in single family residential areas, 400 feet in multiple family residential areas and 350 feet near schools, commercial, and industrial areas.

7-12 Operational Flexibility

Operational flexibility is achieved by providing multiple sources of supply, back-up or stand-by facilities, and looped distribution system piping. Criteria to be applied include:

- Provide multiple sources of supply
- Provide looped system whenever possible
- Provide emergency interconnections with neighboring agencies
- Provide standby generators at wells and pump stations

7-13 Distribution System Maintenance Program

Regular maintenance of a distribution system is an essential part of a properly operated water distribution system. Maintenance should include periodic cleaning and flushing of the system, servicing of valves and hydrants, conducting leak surveys, replacement and repairs, and disinfection of repaired sections. The City's water system maintenance consists of hydrant flushing, hydrant maintenance, and valve exercising. Each maintenance and repair activity is documented.

Flushing

Flushing is performed to remove any accumulated sediments or other impurities which have been deposited in the system pipes. It also helps to restore system capacity. Flushing is performed by causing a large volume of water to pass through a pipe section that has been isolated. Flushing valves or fire hydrants are opened to allow flow into the isolated pipeline and settled sediments are suspended. It is important that system flushing be performed systematically to remove the debris. To determine the volume of water loss, the City should record the length of time the hydrant is opened, and the flow rate by using a flow diffuser with a flow meter.

Servicing of Valves and Hydrants

Valves are often found inaccessible, inoperable, or closed and should therefore be tested and exercised regularly. In the event of a line break, it is important that valves operate properly so that the break can be isolated for repair. Records of repair should require a notation of the time at which valves are closed and reopened so that valves do not remain closed inadvertently.

In additional to isolation valves, the City should exercise and maintain its 28 blowoff valves and 67 air valves, to ensure they are operable when needed.

Hydrants should be periodically inspected for leaks at the hose outlets. Leaking hydrants should be removed and/or reconditioned and then replaced.

Leak Surveys

Comparison of purchase records and customer meter readings and other uses such as system flushing can indicate if excessive leakage is occurring in the system. Leak surveys should be conducted when excessive leakage is suspected.

Water Main Replacement and Repair

Many of the existing pipes in the Old Town community have exceeded their useful lives. Once exceeded these facilities become less reliable and subject to failure. The City should schedule an aggressive annual replacement program to address these old facilities.

Water mains are repaired and/or replaced when pipes are found to be broken, corroded, or leaking. Pipes are either replaced or repaired with a sleeve and clamp around the outside of the damaged section. The method of repair should consider if the line is scheduled for replacement, its location in the system, and the conditions which led to the failure. Following the repair or replacement of any pipe, the line should be flushed and disinfected in accordance with the applicable requirements.

7-14 Water Quality

The quality of water served by the City has to be in accordance with the Federal standards as well as the State of California Department of Public Health (CDPH) standards as set forth in Title 22 of the California Code of Regulations.

The basic water quality standards are established by the Safe Drinking Water Act (SDWA), which was passed by the Congress in 1974. Amendments to the SDWA were enacted in 1986 and 1996. The SDWA mandated the U.S. Environmental Protection Agency (EPA) to develop primary drinking water standards or maximum contaminant levels (MCL'S) in public water supplies.

The CDPH has the responsibility for the State's drinking water program. It is accountable to the EPA for enforcement of the SDWA and for adoption of standards that are at least as stringent as that of the EPA. Since California conducts independent risk assessments, some of its standards are more stringent than the standards of the Federal Government.

The maximum contaminant levels are the maximum permissible levels of contaminants in water, which enter the distribution system of a public water system. MCL'S for bacteriological quality and trihalomethanes are measured within the distribution system. The Federal and State MCL'S are enforceable and must be met by appropriate public drinking water systems.

The Federal maximum contaminant level goals (MCLG's) establish the maximum level of contaminant with an adequate margin of safety that would cause no known or anticipated adverse effect on the health of consumers. MCLG's are non-enforceable health goals based on health considerations only. In California, the Office of Environmental Health Hazard Assessment sets Public Health Goals (PHGs), which are similar to MCLGs in that they are non-enforceable health goals based on health considerations. In California, the exceedance of a PHG triggers a requirement to notify the governing body, and to hold a public meeting during which the cost of treating the water to remove the contaminant is discussed.

The secondary MCL's are established to protect public welfare and to provide pure, wholesome and potable water. They are measured at the point of delivery to the consumer. They involve protection of the taste, odor and appearance of the water. Federal secondary MCL's are not enforceable. The State secondary MCL's are enforceable for all new systems and new sources developed by existing systems.

Notification Levels (NLs) and Response Levels (RLs), (formerly known as "action levels") are set by CDPH based on actual contamination of drinking water supplies, or in anticipation of possible contamination. If an NL is exceeded, notification of the governing body is required. If an RL is exceeded, removal of the source from service is recommended by CDPH. Public notification is not required for NL or RL accidences, but is recommended by the Department of Public Health.

Since the 1986 Amendments, several rules have been promulgated by the EPA. These include:

- Lead and Copper Rule - (June 7, 1991 and revised October 10, 2007 which requires monitoring) requires treatment techniques consisting of optimal corrosion control treatment, source water treatment, public education and lead service line replacement. Revisions to the Lead and Copper Rule are expected in 2012, and may include requirements for lead service line replacement, service sampling and flushing of lines after replacement, and updates to corrosion control guidelines.

- Consumer Confidence Report Rule - (August 19, 1998) requires community water systems to prepare and provide to their customers annual consumer confidence reports on the quality of the water delivered by the systems. This rule allows customers to make health-based decisions regarding their drinking water consumption.

- Radionuclide - (December 7, 2000) This rule finalized the MCLG's, MCL's, and monitoring, reporting and public notification requirements for uranium, combined radium-226 and radium-228, gross alpha particle radioactivity, and beta particle and photon radioactivity.

- Public Notification Rule - (May 22, 2006) requires owners and operators of public water systems to notify customers when they fail to comply with the requirements of the National Primary Drinking Water Regulations; have a variance or exemption from the drinking water regulations; or are facing other situations posing a risk to public health. The rule sets the requirements that the public water systems must follow regarding the form, manner, frequency, and content of a public notice. It also includes the CDPH requirements for sampling, reporting, and recordkeeping.

- Unregulated Contaminant Monitoring Rule - (January 11, 2001) requires EPA to establish a program to monitor unregulated contaminants, and to publish a list of contaminants to be monitored. The first two rounds of monitoring (UCMR1 and UCMR2) have been completed, and development of the contaminant list for the third round of monitoring (UCMR3) is in progress.

- Surface Water Treatment Rule - (June 29, 1989) requires all public water systems using surface water supplies and groundwater under the influence of surface water to filter and disinfect for protection against Giardia lamblia, Legionella, enteric viruses and heterotrophic bacteria.

  The State surface water treatment regulations resulted from a series of amendments to the National Primary Drinking Water Regulations. The State regulations became effective on June 5, 1991. In California, all public water systems must filter all their surface water and part of their groundwater under the influence of surface water.

- Interim Enhanced Surface Water Treatment Rule - (February 16, 1999) The purpose of this rule are to improve control of microbial pathogens including specifically the protozoan Cryptosporidium in drinking water; and address risk tradeoffs with disinfection by-products. The rule establishes a MCLG of zero for Cryptosporidium; 2-log Cryptosporidium removal requirements for systems that filter; strengthened combined filter effluent turbidity performance standards and individual filter turbidity provisions; disinfection benchmark provisions to assure continued levels of microbial protection while facilities take the necessary steps to comply with the new disinfection byproduct standards; inclusion of Cryptosporidium in the definition of groundwater under the direct influence of surface water and in the watershed control requirements for unfiltered public water systems; requirements for covers on new finished water reservoirs; and sanitary surveys for all surface water systems regardless of size. This rule builds upon the treatment technique requirements of the Surface Water Treatment Rule. EPA made the Interim Enhanced Surface Water Treatment Rule effective as of February 16, 1999; while CDPH made the rule effective on in December 2007.

- Total Coliform Rule - (June 29, 1990) Establishes microbiological standards and monitoring requirements for all public water systems. Compliance is based upon the presence or absence of total coliforms. The State regulations are identical to the Federal regulations. The Total Coliform Rule is scheduled for promulgation in 2012. It is anticipated that EPA will remove the no more than 5% positive allowance if over 40 samples are taken per month. Instead, the Total Fecal Coliform and E. coli MCLG standard will be set to 0.

- Arsenic Rule - (November 28, 2008) Establishes a MCL of 0.01 mg/L for arsenic. CDPH made the arsenic rule effective as of November 28, 2008, while the EPA has had the MCL in effect since January 2006.

- Point of Use Treatment – (December 21, 2010) Section 64418 of the California Code of Regulations permits an agency to use point of use treatment devices at the tap, instead of centralized treatment, for compliance with MCL's, when given the approval of CDPH.

- Filter Backwash Rule – This rule applies to conventional or direct filtration treatment systems and recycle spent filter backwash water for protection from Cryptosporidium. It requires that all recycle flows be conveyed to the head of the treatment system for complete treatment.

- Disinfectants and Disinfection by Products Rule -This rule is required by the 1986 Amendments. It must balance the need for protection from cancer causing chemicals that result from disinfection of drinking water (the by-products) with the need to eliminate the microbes through disinfection.

  The first stage of this rule was the Draft Disinfectants/Disinfection By-Products Rule (D/DBPR), proposed on July 29, 1994. The compounds affected by the first stage were as follows:

  Chlorine
  Chloramines
  Chlorine Dioxide

  Total Trihalomethanes (TTHMS)
  Total Haloacetic Acids (THAAS)
  Total Organic Carbon (TOC)
  Bromate
  Chlorite

  The Stage 1 rule proposed MCLS of 0.080 mg/l for trihalomethanes, 0.060 mg/l for total haloacetic acids, 0.010 mg for bromate, 1.0 mg/l for chlorite, determined as the annual average of quarterly measurements. The proposed maximum residual disinfection level for chlorines and chloramines was 4.0 mg/l and for chlorine dioxide was 0.08 mg/l.

  The Stage 2 rule requires an evaluation of water distribution systems, known as an Initial Distribution System Evaluation (IDSE), to identify the locations with high disinfection byproduct concentrations. These locations are then used by the systems as the sampling sites for Stage 2 DBPR compliance monitoring. The MCL for two groups of disinfection byproducts are calculated for each monitoring location in the distribution system. The rule also requires each system to determine if they have exceeded an operational evaluation level, which is identified using their compliance monitoring results.

- Groundwater Rule (October 11, 2006) - This rule, originally named the Groundwater Disinfection Rule, was first proposed in July 1992. The proposed rule, published on May 10, 2000 requires all groundwater systems to disinfect unless they meet natural disinfection requirements or qualify for a variance. This rule will need to be adopted no later than Stage 2 Disinfection By-Products Rule. The proposed rule has a risk based regulatory strategy for addressing risks through a multiple-barrier approach. It relies on five components.

  1. Periodic sanitary surveys of groundwater systems
  2. Hydrogeologic assessments to identify wells sensitive to fecal contamination

3. Source water monitoring for systems drawing from sensitive wells without treatment or with other indications of risk
4. Correction of significant deficiencies and fecal contamination
5. Compliance monitoring to ensure disinfection treatment is reliably operated where it is used.

Note: CDPH has determined that all groundwater wells must provide a treatment that achieves at least 99.99 percent (4-log) inactivation or removal of viruses (starting December 1, 2009).

In addition to the SDWA requirements, Assembly Bill 733 (passed in 1996), required water purveyors with 10,000 or more customers to submit an estimate of the total cost of providing fluoridation facilities at each source of supply. The funding for this requirement has to be provided by the State and not by the water purveyor. The CDPH has a priority list of purveyors to receive funding for fluoridation based upon the lowest cost per connection.

The CDPH California Waterworks Standards, revised and adopted March 9, 2008, describes disinfection requirements (Article 5) and additive regulations (Article 7) for public water systems. New or repaired water mains, reservoirs, and wells must be disinfected and sampled for bacteriological quality in accordance with American Water Works Association Standards. Direct and indirect additives cannot be in contact with the drinking water unless certified as meeting the specifications of the NSF International/American National Standard Institute (NSF/ANSI).

A summary of the federal and state water quality standards are presented in Tables 7-5 and 7-6.

Table 7-5
Primary Drinking Water Standards

Contaminant	EPA MCL (mg/l)	EPA Date	CDPH MCL (mg/l)	CDPH Effective Date
Inorganics				
Aluminum	-	-	1	2/25/1989
Antimony	0.006	07/92	0.006	9/8/1994
Arsenic	0.01	2001	0.01	2008
Asbestos (fibers>10 micrometers)	7 MFL[a]	01/91	7 MFL[a]	9/8/1994
Barium	2	01/91	1	1977
Beryllium	0.004	07/92	0.004	9/8/1994
Cadmium	0.005	01/91	0.005	9/8/1994
Chromium (total)	0.1	01/91	0.05	1977
Copper (AL)	1.30	06/91	1.3	2008
Cyanide (as free cyanide)	0.2	07/92	0.15	6/12/2003
Fluoride	4	04/86	2	04/98
Lead (AL)	0.015[b]	06/91	0.015[b]	12/11/1995
Mercury	0.002	6/24/1977	0.002	1977
Nickel	Remanded		0.1	9/8/1994
Nitrate	(as N) 10	6/24/1977	(as NO3) 45	1977
Nitrite (as N)	1	01/91	1	9/8/1994
Total Nitrate/Nitrite (as N)	10	01/91	10	9/8/1994
Perchlorate			0.006	2007
Selenium	0.05	01/91	0.05	9/8/1994
Thallium	0.002	07/92	0.002	9/8/1994
Radionuclides				
Uranium	30 µg/L	12/7/2000	20 pCi/L	1/1/1989
Combined radium-226 & 228	5 pCi/L	6/24/1977	5 pCi/L	1977
Cross Alpha particle activity	15 pCi/L	6/24/1977	15 pCi/L	6/24/1977
Gross Beta particle activity	4 millirem/yr	6/24/1977	4 millirem/yr	2003
Strontium-90	8 pCi/L	6/24/1977	8 pCi/L[c]	1977
Tritium	20,000 pCi/L	6/24/1977	20,000 Pci/L[c]	1977

Table 7-5
Primary Drinking Water Standards

Contaminant	EPA		CDPH	
	MCL (mg/l)	Date	MCL (mg/l)	Effective Date
Volatile Organic Chemicals (VOCS)				
Benzene	0.005	06/87	0.001	2/25/1989
Carbon tetrachloride	0.005	06/87	0.0005	4/4/1989
Chlorobenzene	0.1		0.1	
1,2-Dichlorobenzene	0.6	01/91	0.6	9/8/1994
1,4-Dichlorobenzene	0.075	06/87	0.005	4/4/1989
1,1-Dichloroethane	-	-	0.005	6/24/1990
1,2-Dichloroethane	0.005	06/87	0.0005	4/4/1989
1,1-Dichloroethylene	0.007	06/87	0.006	2/25/1989
cis-1,2-Dichloroethylene	0.07	01/91	0.006	9/8/1994
trans-1,2-Dichloroethylene	0.1	01/91	0.01	9/8/1994
Dichloromethane	0.005	07/92	0.005	9/8/1994
1,2-Dichloropropene	-	-	0.005	2/25/1989
1,3-Dichloropropane	0.005	01/91	0.0005	6/24/1990
Ethylbenzene	0.7	01/91	0.3	6/12/2003
Monochlorobenzene	0.1	01/91	0.07	9/8/1994
Styrene	0.1	01/91	0.1	9/8/1994
1,1,2,2-Tetrachloroethane	-	-	0.001	2/25/1989
Volatile Organic Chemicals (VOCS)				
Tetrachloroethylene (PCE)	0.005	01/91	0.005	5/1/89
Toluene	1	01/91	0.15	9/8/1994
1,2,4 Trichorobenzene	0.07	07/92	0.005	9/8/1994
1,1,1-Trichloroethane	0.2	06/87	0.2	2/25/1989
1,1,2-Trichloroethane	0.005	07/92	0.005	9/8/1994
Trichloroethylene (TCE)	0.005	06/87	0.005	2/25/1989
Trichlorofluoromethane (Freon)	-	-	0.15	6/24/1990
1,1,2-Trichloro-1,2,2-Trifuoroethane	-	-	1.2	6/24/1990
Vinyl Chloride	0.002	06/87	0.0005	4/4/1989
Xylenes	10	01/91	1.75	2/25/1989

Table 7-5
Primary Drinking Water Standards

Contaminant	EPA		CDPH	
	MCL (mg/l)	Date	MCL (mg/l)	Effective Date
Non-Volatile Synthetic Organic Chemicals (SOCS)				
Acrylamide	TT[e]	01/91	TT[e]	9/8/1994
Alachlor	0.002	01/91	0.002	9/8/1994
Atrazine	0.003	01/91	0.001	6/12/2003
Bentazon	-	-	0.018	4/4/1989
Benzo(a)pyrene (PAHs)	0.0002	07/92	0.0002	9/8/1994
Carbofuran	0.04	01/91	0.018	6/24/1990
Chlordane	0.002	01/91	0.0001	6/24/1990
Dalapon	0.2	07/92	0.2	9/8/1994
1,2-Dibromo-3-chloropropane (DBCP)	0.0002	01/91	0.0002	5/3/1991
Di(2-ethylhexyl)adipate	0.4	07/92	0.4	9/8/1994
Di(2-ethylhexyl)phthalate	0.006	07/92	0.004	6/24/1990
2,4-D	0.07	01/91	0.07	9/8/1994
Dinoseb	0.007	07/92	0.007	9/8/94
Dioxin (2,3,7,8-TCDD)	0.00000003	07/92	0.00000003	9/8/1994
Diquat	0.02	07-92	0.02	9/8/1994
Endothall	0.1	07/92	0.1	9/8/1994
Endrin	0.002	07/92	0.002	9/8/1994
Epichlorahydrin	TT[e]	01/91	TT[e]	9/8/1994
Ethylene dibromide	0.00005	01/91	0.00005	9/8/1994
Glyphosate	0.7	07/92	0.7	6/24/1990
Heptachlor	0.0004	01/91	0.00001	6/24/1990
Heptachlor epoxide	0.0002	01/91	0.00001	6/24/1990
Hexachlorobenzene	0.001	07/92	0.001	9/8/1994
Hexachlorocyclopentadiene	0.05	07/92	0.05	9/8/1994
Lindane	0.0002	01/91	0.0002	9/8/1994
Methoxychlor	0.04	01/91	0.03	6/12/2003
Molinate	-	-	0.02	4/4/1989
Oxamyl (Vydate)	0.2	07/92	0.05	6/12/2003
Pentachlorophenol	0.001	01/91	0.001	9/8/1994
Picloram	0.5	07/92	0.5	9/8/1994
Polychlorinated biphenyls (PCBs)	0.0005	01/91	0.0005	9/8/1994
Simazine	0.004	07/92	0.004	9/8/1994
Thiobencarb	-	-	0.07	4/4/1989
Toxaphene	0.003	01/91	0.003	9/8/1994
2,4,5-TP (Silvex)	0.05	01/91	0.05	9/8/1994

Table 7-5
Primary Drinking Water Standards

Contaminant	EPA		CDPH	
	MCL (mg/l)	Date	MCL (mg/l)	Effective Date
Disinfectants				
Chloramines (as Cl2)	MRDL=4.0		MRDL=4.0	
Chlorine (as Cl2)	MRDL=4.0		MRDL=4.0	
Chlorine dioxide (as ClO2)	MRDL=0.8		MRDL=0.8	
Disinfection Byproducts				
Total trihalomethanes (TTHMs)	0.08	1/1/2002[d]	0.08	6/17/2006
Total haloacteic acids (HAA5)	0.06	1/1/2002[d]	0.06	6/17/2006
Bromate	0.01	1/1/2002[d]	0.01	6/17/2006
Chlorite	1.0	1/1/2002[d]	1.0	6/17/2006
Microorganisms				
Cryptosporidium	TT		TT	
Giardia Lamblia	TT		TT	
Heterotrophic plate count (HPC)	TT		TT	
Legionella	TT		TT	
Total Coliforms (incl. fecal coli & E.coli)	5%		5%	
Turbidity	TT		TT	
Viruses (enteric)	TT		TT	

a. MFL = Million fibers per liter, with fiber length > 10 microns

b. Regulatory Action Level; if system exceeds, it must take certain actions such as additional monitoring, corrosion control studies and treatment, and for lead, a public educaiton program; replaces MCL.

c. MCLs are intended to ensure that exposure above 4 millirem/yr does not occur.

d. Effective for surface water systems serving more than 10,000 people; effective for all others 1/1/04

e. TT = treatment technique, because an MCL is not feasible

Table 7-6
Secondary Drinking Water Standards

Contaminant	EPA MCL (mg/l)	CDPH MCL (mg/l)
Aluminum	0.05 to 0.2	0.2
Chloride	250	250 (Recommended)
Color	15 color units	15
Copper	1.0	1.0
Corrosivity	non-corrosive	
Fluoride	2	
Foaming agents	0.5	0.5
Iron	0.3	0.3
manganese	0.05	0.05
Methyl-*tert* -butyl either (MTBE)		0.005
Odor	3 threshold odor numbers	3 threshold odor numbers
pH	6.5 - 8.5	
Silver	0.1	0.1
Sulfate	250	250 (Recommended)
Thiobencarb		0.001
Total dissoved solids (TDS)	500	500 (Recommended)
Turbidity		5 units
Zinc	5	5

7-15 Future Regulations

Future regulations proposed by the EPA and CDPH that may affect the City of Seal Beach's future water quality, supply, and treatment standards are presented in Table 7-7.

Table 7-7
Future Regulations Proposed by the EPA and CDPH

Regulation	Potential Contaminants	Comments	Anticipated Review Date
Revisions to Total Coliform Rule (TCR)	Total Coliforms Fecal Cloriform / *E. coli*	The TCR, promulgated in 1989, may be revised by EPA. The proposed rule will require the MCLG of E. Coli to be set at 0. Revisions are anticipated to include addressing or monitoring finished water quality in the distribution system.	June 2012
Distribution System Rule	Microbiological Contaminates	Possible changes may include intrusion of facilities, pressure transient monitoring, finished water storage monitoring; and provisions for monitoring nitrification, corrosion, permeation and leaching.	Uncertain
Revisions to the Lead and Copper Rule	Lead and Copper	Revisions to the Lead and Copper Rule may include requirements for lead service line replacment, service sampling and flushing of lines after replacement, and updates to corrosion control guidelines Note: EPA Current Action Limit for Lead = 0.015 mg/L Copper = 1.3 mg/L	June 2012
Fluoride	Flouride	US Department of Health and Human Services has requested that the level of fluoride in drinking water be lowered to 0.7 mg/l. note: EPA current standards are 4mg/l CDPH standards is 4 mg/l	Uncertain
Perchlorate	Perchlorate	A Drinking Water Equivalent Level (DWEL) of 24.5 ppb was established as part of the Integration Risk Information System (IRIS) assuming 100% exposure of drinking water. EPA is expected to establish a MCLG between 2 ppb and 23 ppb. Contribution of perchlorate from food is under review. EPA has determined that perchlorate should be Federally regulated, and it is in the process of creating national primary drinking water regulations for perchlorate. Note: CDPH's MCL Perchlorate is 0.006 mg/l.	Proposed Regulations by February 2013 Final Regulations by August 2014
Radon Rule	Radon	The Radon Rule was promulgated in 1999, but not adopted. EPA may re-propose this rule. The requirements may include monitoring at each entry point to the water system, for 4 consecutive quarters. Final EPA rule with Alternative MCL (AMCL) limits were originally set at 4,000 pCi/L (picoCuries per liter).	Uncertain
Revisions to California Cross Conneciton Rule	Connected Source Water	The cross connection control program is in the process of being revised. Currently, Section 7583 to 7605 of Title 17 of the California Regulations include regulations regarding cross connection control. It provides the requirements to regulate the connections between a potable water system and any connected source, which may or may not contain unapproved water. The draft was last revised in December 2005.	Uncertain

Table 7-7 (Continued)
Future Regulations Proposed by the EPA and CDPH

Regulation	Potential Contaminants	Comments	Anticipated Review Date
California Groundwater Recharge Rule	Groundwater Protection	Draft regulations for the Groundwater Replenishment with Recycled Water were made available for review on November 21, 2011. Comments to the draft will be accepted no later than the end of February 2012. In general, the proposed requirements will provide criteria for projects that will use recycled municipal wastewater to replenish groundwater basins.	Mid 2012
Chromium-6	Chromium-6	EPA and CDPH have currently set the MCLs for total chromium at 0.1 mg/L and 0.05 mg/L, respectively. In July 2011, the Office of Environmental Health Hazard Assessment (OEHHA) established a public health goal (PHG) of 0.02 micrograms per liter (mg/L) for Chromium -6, which has been associated with higher cancer risks in recent years. The CDPH is in the process of establishing a MCL, which should be as close to the PHG, as economically feasible.	Uncertain
Group of Contaminates	Carcinogenic VOCs, Chlorinated DBP, and Nitrosamines Triazines, Chlorinated compounds, perfluoronated compounds, endocrine disrupters, pharmaceuticals and personal care products	EPA has adopted a new strategy of regulating contaminates as groups. The first three groups under consideration for revisions include: Carcinogenic VOCs, Chlorinated DBP, and Nitrosamines. Additional proposed contaminate groups for consideration include: 1) Triazines, other chlorinated compounds, and perfluoronated compounds, 2) Endocrine disrupters, and 3) Pharmaceuticals and Personal Care Products. Regulatory action is expected to address contaminates as groups in 2013 and 2014.	2013

As the primary supplier of the imported water, Metropolitan Water District of Southern California is responsible for meeting the primary and secondary standards for imported water. The City is responsible for maintaining quality, including disinfectant residuals, in its system; and to meet the primary and secondary standards for well water.

7-16 California Domestic Water Supply Permit

On August 21, 2003, the California Department of Health Services, which is now the Department of Public Health (CDPH) issued the City of Seal Beach its Domestic Water Supply Permit (# 05-08-03P-016). The permit is subject to the Title 22 requirements.

In general, the permit recognizes that the City has and will continue to provide the following:

- Knowledge of and compliance with all drinking water regulatory requirements
- Technical, managerial and financial capability

- An adequate source and water supply for the anticipated City demand
- A plan for appropriate operation and maintenance
- Appropriate water treatment
- Compliance with the Waterworks Standards for its distribution system
- State certified water system operators
- Water quality monitoring
- Communication with its consumers
- Emergency response

The Domestic Water Supply Permit does not have an expiration date and does not require renewal. The City must submit amendments to its permit for the following events:

- Change in ownership of the water system
- Addition of a new water source
- Change in the water treatment method
- Addition of storage reservoirs
- Major expansion of the service area
- Change in the distribution system that does not comply with the waterworks standards

The City is in the process of amending its Domestic Water Supply Permit, since the completion of the Lampson Avenue Well.

SECTION 8

HYDRAULIC MODEL

8-1 Introduction

A computer model of the City's water system was utilized to aid in the evaluation of the adequacy of the existing facilities.

Hydraulic analyses were performed using Innovyze's (formerly MWHSoft) InfoWater program, which is a commercially available hydraulic modeling software package that is designed to simulate steady state and extended period operations of water systems.

The development of the computer model began with the establishment of the network pipes and nodes. Nodes represent points of intersection, changes in diameter, fire hydrant locations, or locations where supply or demands are applied to the system. Modeling information associated with each node includes elevation, water demand, and diurnal pattern of demand.

Modeling information associated with each pipe includes size, length, and roughness. Pipe sizes and geometry were obtained from the City's available water plans and atlas maps, as well as discussions with City staff. The model includes all pipes in the City's system, excluding the service laterals, fire hydrant laterals, and private water lines.

The features included in the water model are as follows:

- 73.4 miles of transmission and distribution mains, 4-inches to 20-inches in diameter
- 2 Booster pump stations (Navy and Beverly Manor), 5 pumps total
- 4 Active wells (Leisure World, Beverly Manor, Bolsa Chica, and Lampson Avenue), 4 pumps total
- 2 Forebay reservoirs with a total capacity of 7 million gallons (Navy and Beverly Manor)
- 1 altitude valve (Navy Reservoir)
- 1 WOCWB connection (represented as a negative flow that provide a desired pressure)
- 680 fire hydrants

8-2 Demand Distribution

The water demand distribution was based upon water meter data for the 2009-2010 fiscal year. The average annual demand for every meter in the City's water system was linked to the center of its associated parcel. Polygons were created around each model node. The demands were then aggregated and assigned to the appropriate modeling node. They were then universally adjusted to match the existing water use, for each modeled scenario (average day, maximum day, etc.). This method of distributing demands inherently accounted for any high water users at the correct location within the service area.

8-3 Diurnal Demand Curves

The development of diurnal demand curves are discussed in Section 4-5. Due to the high irrigation water use within the Leisure World community, two diurnal demand curves were created: one for the Leisure World residential community and one for the rest of the City.

8-4 Friction Coefficients

The friction coefficients utilized in the hydraulic model are shown in Table 8-1. The friction coefficients are based on pipe material and pipe size.

Table 8-1
Friction Coefficients

Pipe Size (in)	Material				
	ACP	cip	DIP	Mortar Lined Steel	PVC
4	100	100		110	115
6	115	110	115		110
8	120	110	120		120
10	125	110			125
12	130	115	130	130	130
14	130		135		
16	135		140		140
18	145			145	
20	150				

8-5 Pressure Controls

System pressure is maintained through the pressure at the imported water supply connection, and the pumping at varying speeds based upon demand at the (2) booster pump stations, Bolsa Chica Well, and Lampson Avenue Well.

Typically, the City has utilized Beverly Manor Pump Station and imported water supply during the summer months.

West Orange County Water Board Imported Water - The West Orange County Water Board (WOCWB) is capable of providing approximately 10 cfs at 115 psi at the City turnout. During maximum day demands, the City uses 5 cfs of imported water at 75 to 80 psi pressure on the outlet of the turnout.

Well and Booster Pump Station Pump Control - The Beverly Manor Booster Pump Station, Navy Booster Pump Stations, Bolsa Chica Well, and Lampson Avenue Well pump directly into the distribution system. Table 8-2 details the operational pressure settings that the City maintains at these facilities.

Table 8-2
Operational Pressure Settings

Facility	Operational Pressure Setting (psi)	Emergency Setting (psi)
Beverly Manor Booster Pump Station	60 - 66	46
Navy Booster Pump Station	58 - 62	NA
Bolsa Chica Well	60 - 65	40
Lampson Avenue Well	60 - 65	38

Navy Booster Pump Station typically remains in operation at all times to provide adequate pressures in the Marina Hill area during high demand periods. Beverly Manor Booster Pump Station, Bolsa Chica Well, and Lampson Avenue Well are rotated to supply the system demands as needed. When these facilities are not turned on to the operational pressure setting, they are set to a very low emergency setting that provides redundancy in the event of an emergency such as a fire or pipe break. Should the pressure at the any idle facility drop below the emergency setting, the facility pumps will respond to provide the necessary water.

Valve Controls

At the Navy facility, an altitude valve is used to regulate the flow into the reservoir. The valve is set to open during the low demand periods in the day. This occurs when the upstream pressures are greater than the valve pressure setting, which is currently between 58 psi and 62 psi. An alarm at the reservoir will alert the City when the water level in the reservoir reaches 30 feet.

8-6 Model Calibration

The existing water system model was calibrated by closely matching the demands and pressures to field measured values. The resulting model can be used to analyze the system under various operating conditions. The selected calibration day was Monday June 6, 2011.

Demands

The total system demand was set to 3,068 gpm, which was the calculated daily production for the calibration day.

Pressure Controls

The Bolsa Chica Well and the Lampson Avenue Well were operated during the calibration day. The Navy Booster Pump Station is operated to maintain pressure in the south part of the City during the high demand periods. Table 8-3 details the discharge pressure settings at these facilities, which were determined from the SCADA information on the calibration day.

Table 8-3
Calibration Day Pressure Control Settings

	Lampson Avenue Well	Bolsa Chica Well	Navy Booster Pump Station
Discharge Pressure	63 psi	64 psi	57 psi

Field Data

SCADA data and pressure information was collected from June 3, 2011 to June 13, 2011 and used in calibrating the 24-hour extended period simulation. Pressure data loggers were installed on fire hydrants at 12 locations throughout the system. The selected locations, shown on Figure 8-1, were scattered throughout the service area in order to obtain representative pressure measurements in all areas of the system.

Calibration Results

Table 8-4 illustrates the results of the field pressure recordings and the pressures calculated by the model. The difference between measured pressures and the model output range from 0.2 psi to 3.4 psi. The average difference for all pressure readings was 1.8 psi. The percentage differences ranged from 0.3 percent to 5.2 percent. On average, the percentage difference was 2.9 percent.

Typically, pressure differences of 5 percent and less are considered to be good indicators of the model's overall accuracy. The pressure differences greater than 5 percent are most likely due to several factors that collectively affect the calibration accuracy. Some of these factors, which could result in higher or lower pressures, include differences between model node elevations and actual field elevations, inaccuracies in the pressure monitoring equipment, and partially closed valves. Although there were two (2) locations where the difference between the model and field pressures slightly exceeded 5 percent, the model is considered well calibrated, and representative of the system.

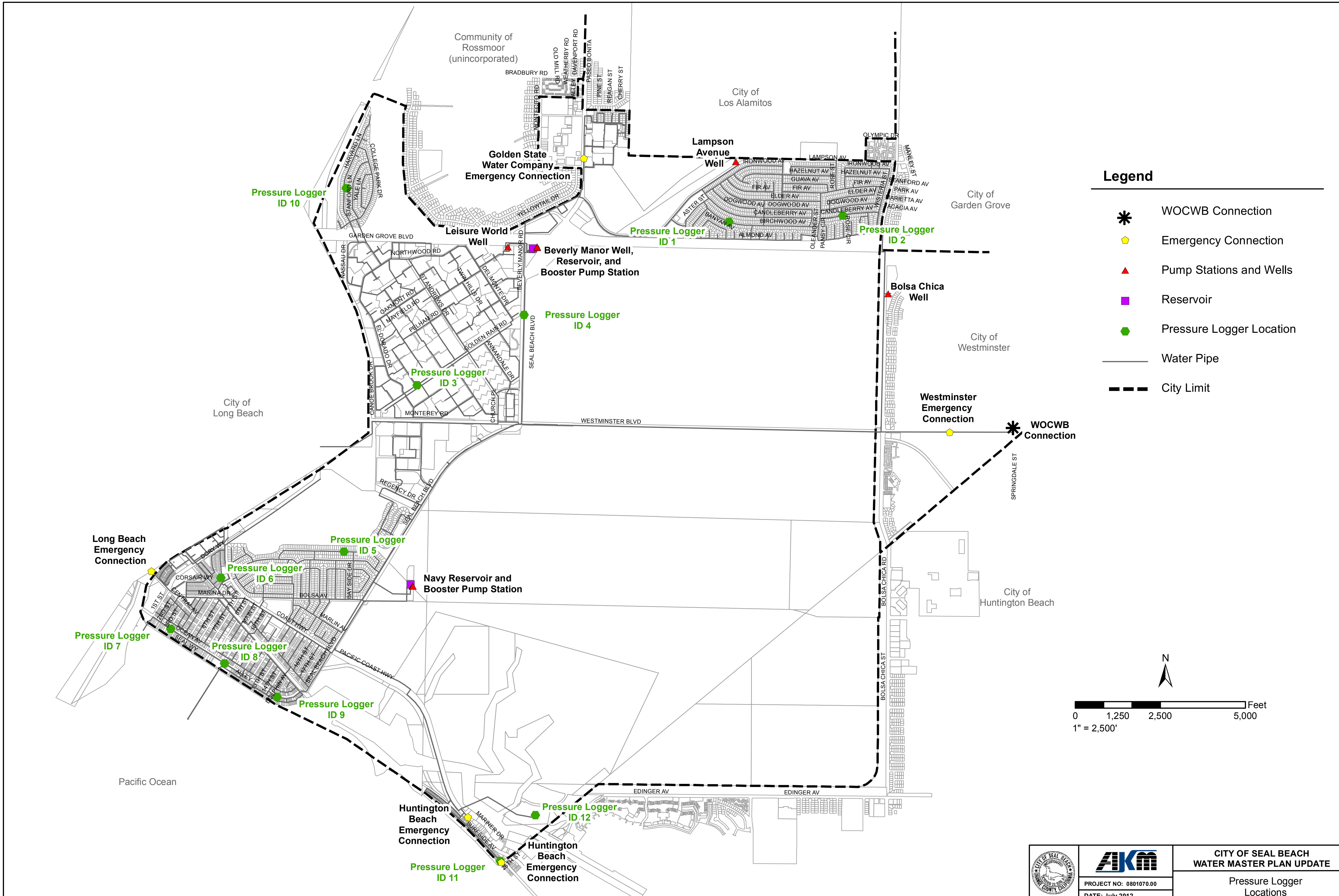

Legend
WOCWB Connection
Emergency Connection
Pump Stations and Wells
Reservoir
Pressure Logger Location
Water Pipe
City Limit
Community of Rossmoor (unincorporated)
City of Los Alamitos
City of Garden Grove
City of Westminster
City of Long Beach
City of Huntington Beach
Pacific Ocean
Golden State Water Company Emergency Connection
Lampson Avenue Well
Leisure World Well
Beverly Manor Well, Reservoir, and Booster Pump Station
Bolsa Chica Well
Westminster Emergency Connection
WOCWB Connection
Long Beach Emergency Connection
Navy Reservoir and Booster Pump Station
Huntington Beach Emergency Connection
Huntington Beach Emergency Connection
Pressure Logger ID 1
Pressure Logger ID 2
Pressure Logger ID 3
Pressure Logger ID 4
Pressure Logger ID 5
Pressure Logger ID 6
Pressure Logger ID 7
Pressure Logger ID 8
Pressure Logger ID 9
Pressure Logger ID 10
Pressure Logger ID 11
Pressure Logger ID 12
GARDEN GROVE BLVD
WESTMINSTER BLVD
SEAL BEACH BLVD
BOLSA CHICA RD
BOLSA CHICA ST
EDINGER AV
PACIFIC COAST HWY
SPRINGDALE ST
N
0 1,250 2,500 5,000 Feet
1" = 2,500'
CITY OF SEAL BEACH WATER MASTER PLAN UPDATE
PROJECT NO: 0801070.00
DATE: July 2012
Pressure Logger Locations
Figure 8-1

Table 8-4
Water System Model Calibration
Comparison of Nodal Pressure Readings

Location ID	Cross Streets	Fire Hydrant ID	Date of Data Collection	Pipe Size (in)	Logger Pressure Maximum (psi)	Logger Pressure Minimum (psi)	Logger Pressure Average (psi)	Model Average Pressure (psi)	Average Pressure Difference (psi)	% Difference
1	4260 Candleberry Ave, Between Aster St and Daisy Cir.	1480	6/6/11	6	69.0	60.9	66.3	66.1	0.2	0.3%
2	4796 Candleberry Ave and Violet St.	1550	6/6/11	8	64.3	56.8	61.5	64.7	3.2	5.2%
3	1421 Goldenrain Rd, Bldg 87 at Alderwood Ln	F7060	6/6/11	8	71.5	53.3	65.9	62.5	3.4	5.2%
4	Clubhouse #1, 1880 Goldenrain Rd at Driveway to Woodshop	5160	6/6/11	10	68.5	51.2	63.6	61.0	2.7	4.2%
5	1630 Crestview Ave and Bayside Dr	F4950	6/6/11	6	46.6	36.5	42.3	41.6	0.6	1.5%
6	424 Galleon Way and Schooner Way	F4222	6/6/11	8	66.4	56.5	61.9	59.9	2.0	3.2%
7	300 Ocean Ave at 3rd St	F3020	6/6/11	12	59.9	49.4	55.3	56.3	1.1	1.9%
8	Ocean Ave at Pier/Main St	F3044	6/6/11	12	59.3	49.7	55.0	57.4	2.4	4.4%
9	Ocean Ave. at Dolphin	F3190	6/6/11	8	65.3	54.6	60.8	59.7	1.1	1.8%
10	168 Harvard Ln at Occidental Ln	F6060	6/6/11	8	69.2	50.8	64.1	61.5	2.6	4.0%
11	Surfside Avenue at Anderson St, Just inside Gate	F8166	6/6/11	8	64.3	55.7	60.7	59.9	0.8	1.3%
12	Sunset Aquatic Park, in planter near PS	F8260	6/6/11	12	65.4	55.1	61.3	59.9	1.4	2.2%
								Average	**1.8**	**2.9%**

Hydrant Flow Testing

Hydrant flow testing was conducted in the field on Wednesday, February 1, 2012 to further refine the calibrated model. The field testing was performed at seven (7) hydrants by City and AKM staff. Portable pressure gauges were set up on two (2) nearby hydrants in the vicinity of the flow hydrant. The static pressures were recorded at each flow hydrant and the nearby hydrants. When the flow hydrant was opened, the available flows were recorded and the residual pressures were recorded at the two (2) nearby hydrants. The flow test hydrant locations are shown on Figure 8-2.

SCADA information was also gathered as part of the hydrant flow testing. The hydrant tests were coordinated with a City maintenance staff member who recorded the following information at the SCADA base control station before the flow hydrant was opened and while the flow hydrant was opened:

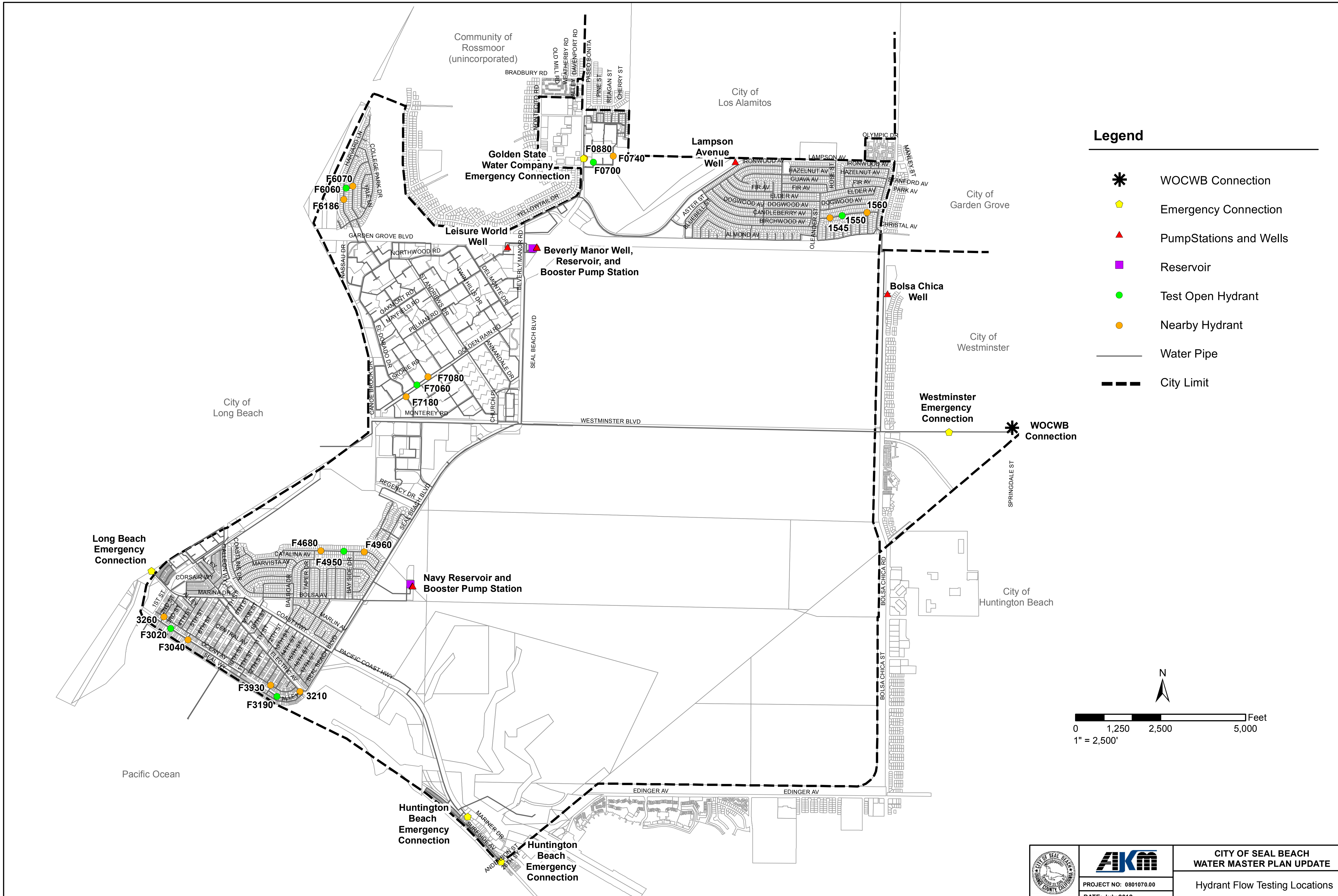
- Lampson Avenue Discharge Pressure
- Lampson Avenue Well Flow Rate
- Lampson Avenue Well Pump Speed
- Navy Booster Pump Station Discharge Pressure
- Navy Booster Pump Station Flow Rate
- Navy Booster Pump Station Pump Speed

Bolsa Chica Well flows and discharge pressures were estimated from the February 1, 2012 chart recordings. The model was adjusted to reflect the conditions of the hydrant flow testing day. The City-wide demands, facility flows, facility pressures, and hydrant flows were input into the model to reflect the actual real-time field results.

Following the field flow testing, the recorded pressures were compared to the model results, which are included in Tables 8-5.

The pressure drop (difference between static and residual pressure at the nearby hydrants) is used for comparison purposes when calibrating the model. This is considered more accurate due to the fact that the actual field elevations may not match the model elevations. As appropriate, the model was adjusted to reflect the results of the hydrant flow testing. The friction coefficients were adjusted, as necessary.

If the difference in the pressure drop between the field results and the model results were less than 5 psi, the model was considered to be representative of the existing system. As detailed in Table 8-4, the pressure drop difference was less than 5 psi at 13 of the 14 nearby hydrant locations. Factors that may have contributed to the pressure differential include corroded laterals to the fire hydrants, partially closed valves at the hydrants, inaccurate model node elevations versus actual field elevations, and inaccuracies in the pressure monitoring equipment. The model is considered to be representative of the existing system.



CITY OF SEAL BEACH
WATER MASTER PLAN UPDATE

Hydrant Flow Testing Locations

Figure 8-2

Table 8-5
Hydrant Flow Test Results

Open Hydrant					Nearby Hydrants								
							Field Results			Model Results			
Site No.	Hydrant ID	Time	Flow (gpm)	Location	Nearby Hydrant Test	Hydrant ID	Static Pressure (psi)	Residual Pressure (psi)	Pressure Drop (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Drop (psi)	Difference in Pressure Drop (psi)
1	1550	9:45	1,032	Candleberry Ave, east of Oleander St	1	1545	66.0	63.8	2.2	67.0	65.3	1.7	**0.5**
					2	1560	66.0	64.0	2.0	66.2	65.4	0.8	**1.2**
2	F4950	11:50	776	Crestview Ave, west of Bayside Dr	1	F4960	50.5	47.5	3.0	50.7	46.8	3.9	**-0.9**
					2	F4680	50.0	40.0	10.0	50.6	46.0	4.6	**5.4**
3	F7060	10:52	899	Golden Rain Rd and Alderwood Ln	1	F7080	68.0	64.5	3.5	68.1	62.5	5.6	**-2.1**
					2	F7180	68.0	65.0	3.0	68.1	63.4	4.8	**-1.8**
4	F6060	11:20	961	Harvard Ln and Occidental Ln	1	F6186	67.0	57.5	9.5	66.6	52.9	13.7	**-4.2**
					2	F6070	67.0	56.0	11.0	66.4	52.0	14.4	**-3.4**
5	F0700	10:25	1,020	East of Seal Beach Bvd, behind CVS Pharm	1	F0880	64.0	59.0	5.0	66.9	62.6	4.3	**0.7**
					2	F0740	62.0	58.0	4.0	65.6	61.1	4.5	**-0.5**
6	F3190	12:27	899	Ocean Ave and Dolphin Ave	1	3210	65.0	62.5	2.5	66.8	63.8	3.0	**-0.5**
					2	F3930	62.0	60.5	1.5	65.9	62.7	3.1	**-1.6**
7	F3020	12:49	899	Ocean Ave and 3rd St	1	F3040	58.0	54.0	4.0	61.4	56.9	4.5	**-0.5**
					2	3260	56.0	52.0	4.0	63.1	58.7	4.4	**-0.4**

SECTION 9

SYSTEM EVALUATION

9-1 Introduction

The established system criteria, calibrated system computer model, and condition assessment were utilized in analyzing the system, and evaluating its adequacy. As discussed in Section 8, the system model was calibrated by simulating actual system conditions and making adjustments to the model. The model was then utilized to analyze the existing system under average day, maximum day, peak hour, and maximum day plus fire flow conditions.

Existing system deficiencies were identified and mitigation projects were formulated based upon the results of the model runs and input from City staff. Proposed projects were added in the hydraulic model to test the operation of the system after their implementation.

A capital improvement program was developed as a result of these analyses. Recommended projects and cost estimates are discussed in Section 10 of this Master Plan Report.

9-2 Source of Supply

The criterion for source of supply is providing one maximum day demand (4,120 gpm). The City is fortunate to have access to groundwater from the Orange County Main Groundwater Basin, which is managed by OCWD. One hundred percent (100%) of the City's maximum day demands can be supplied by a combination of the four (4) groundwater wells, even if imported water is unavailable.

If groundwater is unavailable, the City can supply the maximum day demands with the maximum available imported water supply from WOCWB (10 cfs or 4,488 gpm), which is 109 percent of the maximum day demand.

The existing four (4) emergency connections with Long Beach, Westminster and Huntington Beach can also be activated under emergency conditions provided they are not affected by the same outage.

9-3 Storage

For a water system such as the City's, three (3) categories of storage are of importance: fire suppression, operational, and emergency. The storage criteria are discussed in further detail in Subsection 7-4.

<u>Fire Suppression Storage</u>

To deliver the maximum fire flow of 4,000 gpm for 4 hours, a storage volume of 0.96 million gallons (MG) is required.

The required storage has been increased by 15 percent to 1.10 MG (1.15 x 0.96 MG) to account for variations in elevation, and to provide submergence over the reservoir outlet pipe.

Operational Storage

Operational Storage serves to equalize variations in sources of supply and demand over short periods of time (daily or weekly). Utilizing the system diurnal curve developed for this study, this is approximately 16 percent of the daily demand. However, a minimum of 35 percent of the average day demand (0.35 x 5.93 MG = 2.08 MG) should be provided to account for operation during a maximum day.

The required storage has been increased 15 percent to 2.39 MG (1.15 x 2.08 MG) to account for variations in elevation, and to provide submergence over the reservoir outlet pipe.

Emergency Storage

The City can provide the full average day demand (2,169 gpm) and maximum day demand (4,120 gpm) during an emergency event with water from its local supplies. In case of an electric power outage concurrent with Metropolitan Water District supply interruption, the Bolsa Chica Well (3,000 gpm) and the current Beverly Manor Well and booster pumps (2,100 gpm) can be operated by natural gas engines. While the City is in the process of converting the gas engines at the Beverly Manor well and booster pump station to electric motors, the City plans to provide a natural gas engine generator as a backup power source in the event of a commercial power outage. It is recommended that the Lampson Avenue Well (3,000 gpm) be equipped with an emergency generator to operate this facility during power outages.

Because of the availability of groundwater supplies, the City's system does not currently require emergency storage.

Total Storage

The total storage is summarized below:

Fire Suppression	1.10 MG
Operational	2.38 MG
Emergency (Available from Groundwater)	0 MG
Total	**3.48 MG**

The two existing reservoirs have a total usable capacity of 6.3 MG, which is significantly greater than the required total storage. To further increase its reliability, the City has the capability of utilizing its emergency connections with the City of Long Beach, the City of Huntington Beach, and the Golden State Water Company.

The City currently does not require any additional storage. Whenever either reservoir is scheduled to be replaced, the City should reevaluate its water usage, operations, and redevelopment plans to determine if additional storage may be required.

9-4 Model Runs and System Pressures

The hydraulic model was utilized to analyze the existing system under average day, maximum day, peak hour, and maximum day plus fire flow conditions. A description of the City's hydraulic model is included in Section 8.

The hydraulic model was used to analyze six (6) scenarios, which consisted of different combinations of the City's water sources: Lampson Avenue Well, Bolsa Chica Well, WOCWB turnout, and the Beverly Manor Booster Pump Station (supplied by Beverly Manor Well and Leisure World Well). All analyses were run with the Navy Booster Pump Station in operation. The pressure ranges for each of these scenarios under average day, maximum day, and peak hour maximum day demands is summarized in Table 9-1.

Table 9-1
Scenario System Pressures

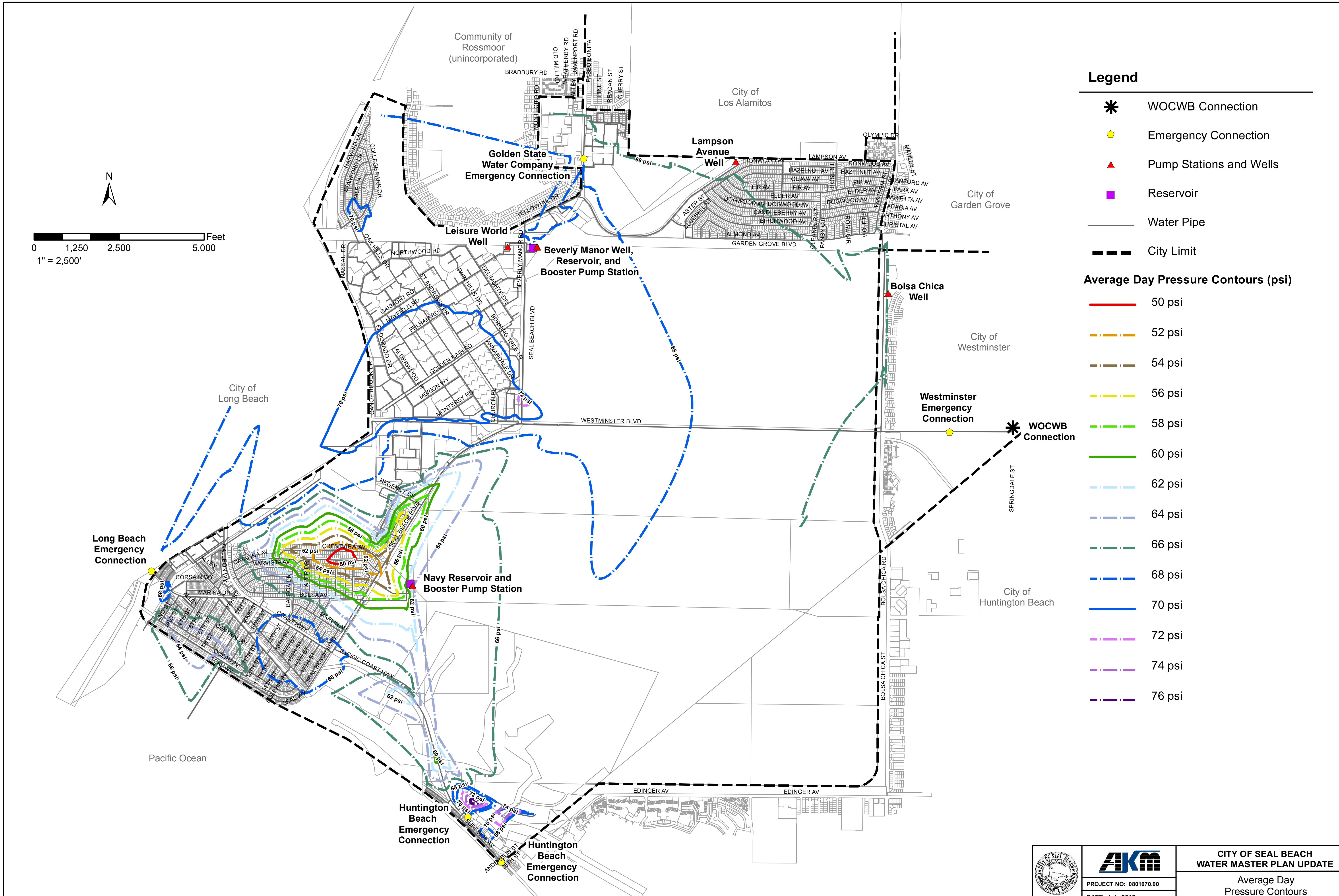
Scenario	Facilities in Operation	Average Day Demands		Maximum Day Demands		Peak Hour Maximum Day Demands	
		Pressure Range (psi)	Satisfy 40 psi Requirement?	Pressure Range (psi)	Satisfy 40 psi Requirement?	Pressure Range (psi)	Satisfy 40 psi Requirement?
1	Beverly Manor Booster Pump Station WOCWB Connection	48-77 psi	Yes	47-76 psi	Yes	38-67 psi	Low pressures are experienced in the Marina Hill area only during the early morning hours due to the high irrigational usage by the Leisure World Community.
2	Beverly Manor Booster Pump Station Bolsa Chica Well	49-78 psi	Yes	48-77 psi	Yes	42-71 psi	Yes
3	Lampson Avenue Well Bolsa Chica Well	48-77 psi	Yes	46-76 psi	Yes	32-68 psi	Low pressures are experienced in the Marina Hill area only during the early morning hours due to the high irrigational usage by the Leisure World Community.
4	Lampson Avenue Well Beverly Manor Pump Station	48-77 psi	Yes	46-76 psi	Yes	38-68 psi	Low pressures are experienced in the Marina Hill area only during the early morning hours due to the high irrigational usage by the Leisure World Community.
5	Bolsa Chica Well WOCWB Connection	48-77 psi	Yes	46-75 psi	Yes	38-67 psi	Low pressures are experienced in the Marina Hill area only during the early morning hours due to the high irrigational usage by the Leisure World Community.
6	Lampson Avenue Well WOCWB Connection	48-77 psi	Yes	46-75 psi	Yes	39-69 psi	Low pressures are experienced in the Marina Hill area only during the early morning hours due to the high irrigational usage by the Leisure World Community.

Average Day Demand

Pressures during average day demands were above the City's dynamic pressure criteria (40 psi) throughout the service area. Typically, the City will operate the Bolsa Chica Well and the Beverly Manor Well (Scenario 2) during an average day demand. The average day pressure contours for Scenario 2 are shown in Figure 9-1.

Maximum Day Demand

During the warmer summer months, the City generally utilizes groundwater from the Beverly Manor or Leisure World Wells and imported water from the WOCWB connection (Scenario 1). The maximum day demand pressure contours for Scenario 1 are shown on Figure 9-2. The maximum day demand for each of the 6 scenarios did not indicate any hydraulic deficiencies. System pressures range from 46 psi in the Marina Hill area to 77 psi near the Aquatic Park.



Legend
WOCWB Connection
Emergency Connection
Pump Stations and Wells
Reservoir
Water Pipe
City Limit
Average Day Pressure Contours (psi)
50 psi
52 psi
54 psi
56 psi
58 psi
60 psi
62 psi
64 psi
66 psi
68 psi
70 psi
72 psi
74 psi
76 psi
N
Feet
0
1,250
2,500
5,000
1" = 2,500'
Community of Rossmoor (unincorporated)
City of Los Alamitos
City of Garden Grove
City of Westminster
City of Long Beach
City of Huntington Beach
Pacific Ocean
Golden State Water Company Emergency Connection
Lampson Avenue Well
Leisure World Well
Beverly Manor Well, Reservoir, and Booster Pump Station
Bolsa Chica Well
Westminster Emergency Connection
WOCWB Connection
Long Beach Emergency Connection
Navy Reservoir and Booster Pump Station
Huntington Beach Emergency Connection
Huntington Beach Emergency Connection
WESTMINSTER BLVD
SEAL BEACH BLVD
GARDEN GROVE BLVD
BOLSA CHICA RD
BOLSA CHICA ST
SPRINGDALE ST
EDINGER AV
PACIFIC COAST HWY
LAMPSON AV
NORTHWOOD RD
CITY OF SEAL BEACH
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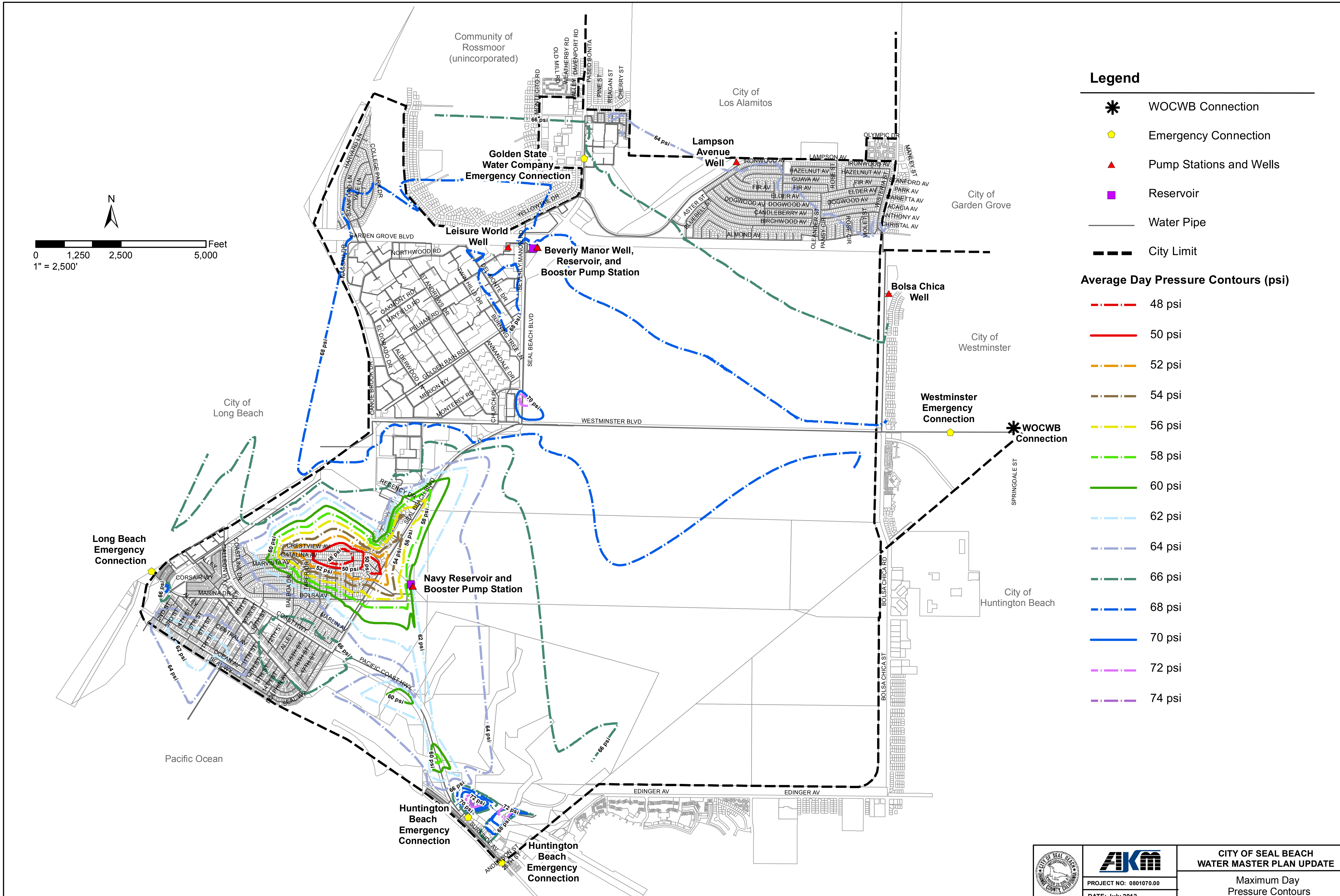
PROJECT NO: 0801070.00
DATE: July 2012
Average Day Pressure Contours
Figure 9-1


Legend
WOCWB Connection
Emergency Connection
Pump Stations and Wells
Reservoir
Water Pipe
City Limit
Average Day Pressure Contours (psi)
48 psi
50 psi
52 psi
54 psi
56 psi
58 psi
60 psi
62 psi
64 psi
66 psi
68 psi
70 psi
72 psi
74 psi
N
0 1,250 2,500 5,000 Feet
1" = 2,500'
Community of Rossmoor (unincorporated)
City of Los Alamitos
City of Garden Grove
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WOCWB Connection
Long Beach Emergency Connection
Navy Reservoir and Booster Pump Station
Huntington Beach Emergency Connection
Huntington Beach Emergency Connection
GARDEN GROVE BLVD
NORTHWOOD RD
SEAL BEACH BLVD
WESTMINSTER BLVD
LAMPSON AV
SPRINGDALE ST
BOLSA CHICA RD
EDINGER AV
PACIFIC COAST HWY
COAST HWY
CRESTVIEW AV
CATALINA AV
MARVISTA AV
BOLSA AV
CORSAIR WY
MARINA DR
CENTRAL AV
OCEAN AV
SEAL WY
ANDERSON ST
SURFSIDE AV
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DATE: July 2012
Maximum Day Pressure Contours
Figure 9-2

Maximum Day Peak Hour Demand

The maximum day peak hour demand pressure contours for Scenario 1 are shown on Figure 9-3. Currently the model simulates the peak demand at 1:15 a.m, due to the high irrigation flows in the Leisure World community. For most of the scenarios, the City is unable to provide the dynamic pressure criteria (40 psi), during the maximum day peak hour demands. The minimum pressures in the Marina Hill area range between 38 psi and 42 psi for five (5) of the six (6) scenarios. The analysis indicates that the maximum day peak hour pressures are the lowest for Scenario 3, which provided a minimum pressure of 32 psi. Scenario 3 includes the operation of the Lampson Avenue Well and the Bolsa Chica Well. The main cause of the low pressures is the distance between the two wells to the west and south side of the City, where the majority of the demand is located. These wells are connected to the west and south side of the City by the following two connections which incur more system head loss than the other five options:

- 12-inch pipe in Lampson Avenue between Basswood Street and Seal Beach Boulevard
- 12-inch pipe between the Bolsa Chica Well and the 18-inch pipe in Westminster Boulevard

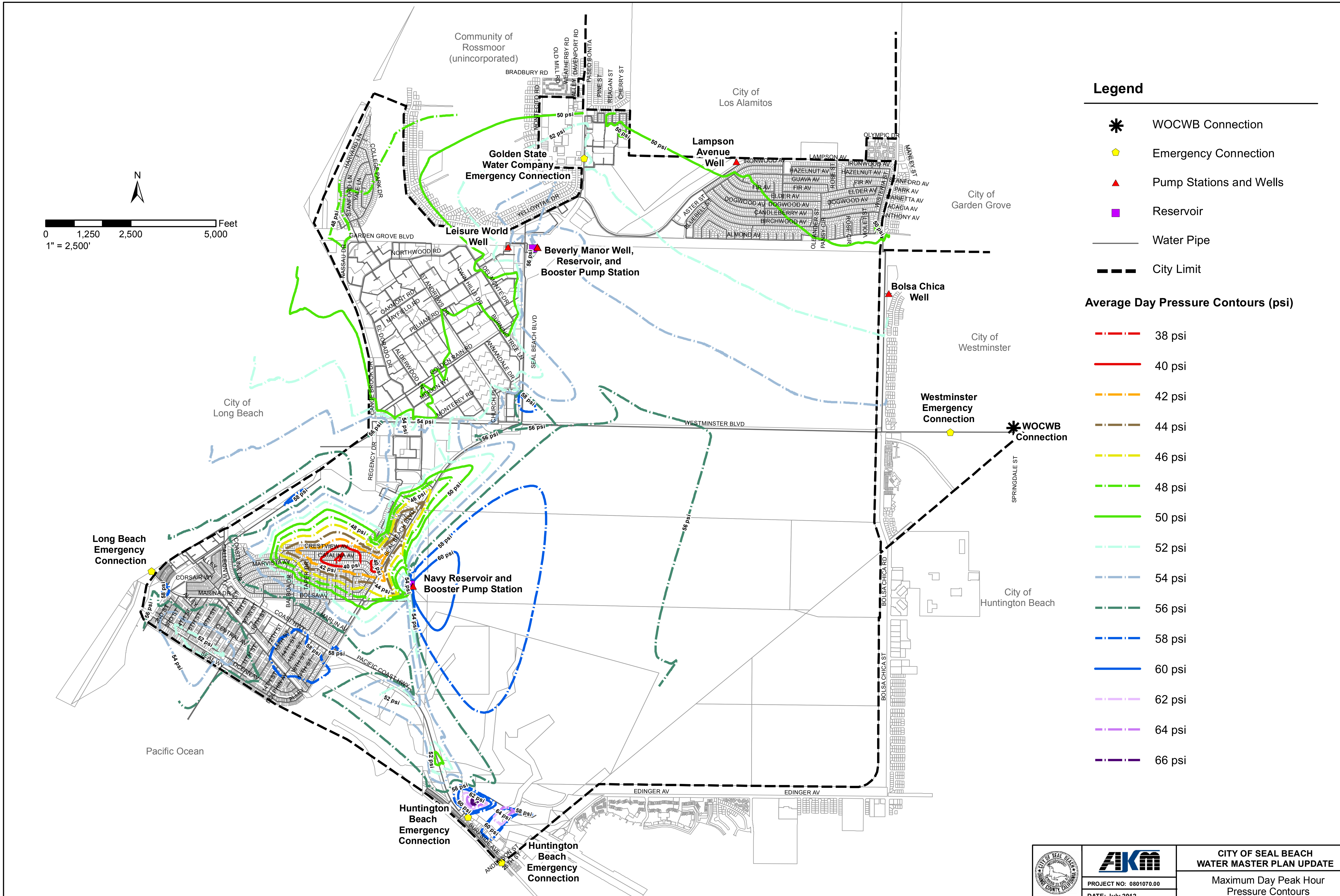
Aside from low estimated pressures when the Bolsa Chica Well and Lampson Avenue Well are in operation, the maximum day peak hour pressures are slightly less than the 40 psi criteria. These low pressures occur in the Marina Hill area during peak hour irrigation usage in Leisure World at around 1:15 a.m., when the majority of the residents are asleep. During the typical residential peak hour at 7:00 a.m., the hydraulic model indicates that the system is capable of providing the 40 psi requirement in the Marina Hill area. Should the low pressures in the Marina Hill area become a common occurrence, the City may consider utilizing a third source of water during the maximum month water usage periods.

Maximum Day Demand plus Fire Flow

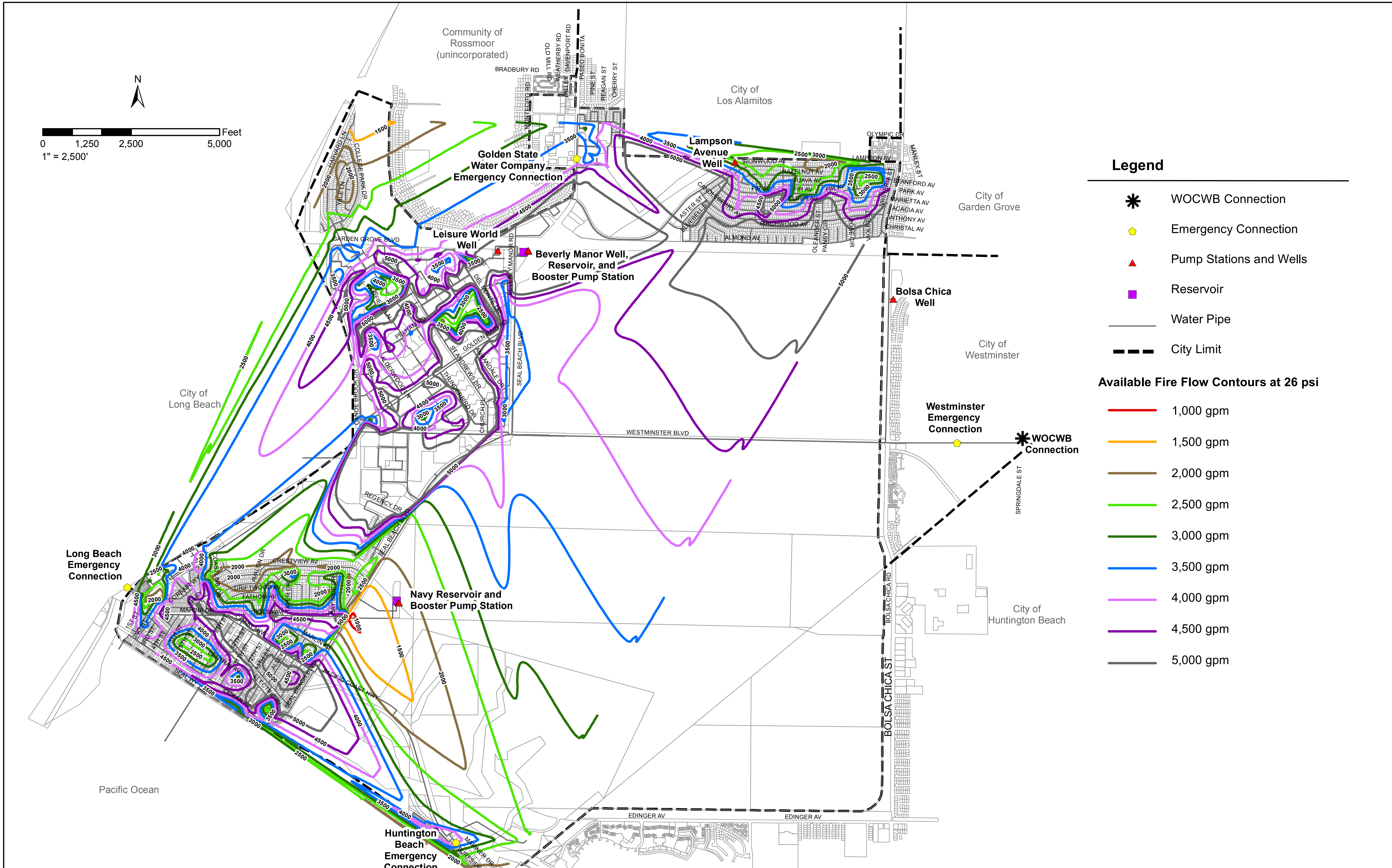
The maximum day demand plus fire flow scenarios revealed one (1) deficiency in the system where the required residual pressure could not be met. The fire flow criterion requires a residual pressure of 20 psi at the fire hydrant outlet. The hydraulic model does not include laterals from the mainline to the hydrants. It is estimated that there can be a loss of up to 6 psi through a lateral and hydrant at 1,000 gpm. The system evaluation is therefore based on providing 26 psi at the nearest mainline junction in the model. Figure 9-4 illustrates the flow rate available while maintaining 26 psi at each individual model hydrant during the maximum day demand scenario for the existing system.

Since the analyses were conducted for the maximum day period, the model was set up with the Beverly Manor Well, Beverly Manor Booster Pump Station, Navy Booster Pump Station and the MWD connection in operation. During a fire flow event, the low pressures at the Lampson Avenue Well or Bolsa Chica Well would be less than their emergency settings of 40 psi and 38 psi, respectively. As discussed in Section 8-5, the facilities will respond to provide the necessary fire flows. For the fire flow analysis, the model was also set up with the Lampson Avenue Well placed into operation.

Fire flow was applied at each hydrant in accordance with the California Fire Code (Table 105.1) and the criteria established in Section 7-11. In summary, the fire flow applied in a single family residential area is 2,000 gpm; in a multi- family residential area is 3,000 gpm; near a school is 3,500 gpm; in a commercial or industrial area is 4,000 gpm. If two land uses are present in the same area, the higher fire flow was used.



Maximum Day Peak Hour Pressure Contours
Figure 9-3



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AKM

PROJECT NO: 0801070.00

DATE: July 2012

Available Fire Flow Contours

Figure 9-4

According to the California Fire Code, the fire flow requirement may be reduced by 50 percent when the building is equipped with an approved automatic sprinkler system. Some commercial and multiple family residential buildings require larger fire flows than those included in this master plan based on their building square footage. It is recommended that these facilities install automatic fire sprinklers to reduce their fire flow requirement to comply with the criteria included in this master plan.

For most of the model analyses, fire flow was taken at more than one hydrant. This is especially necessary in commercial and industrial areas where the criterion is 4,000 gpm.

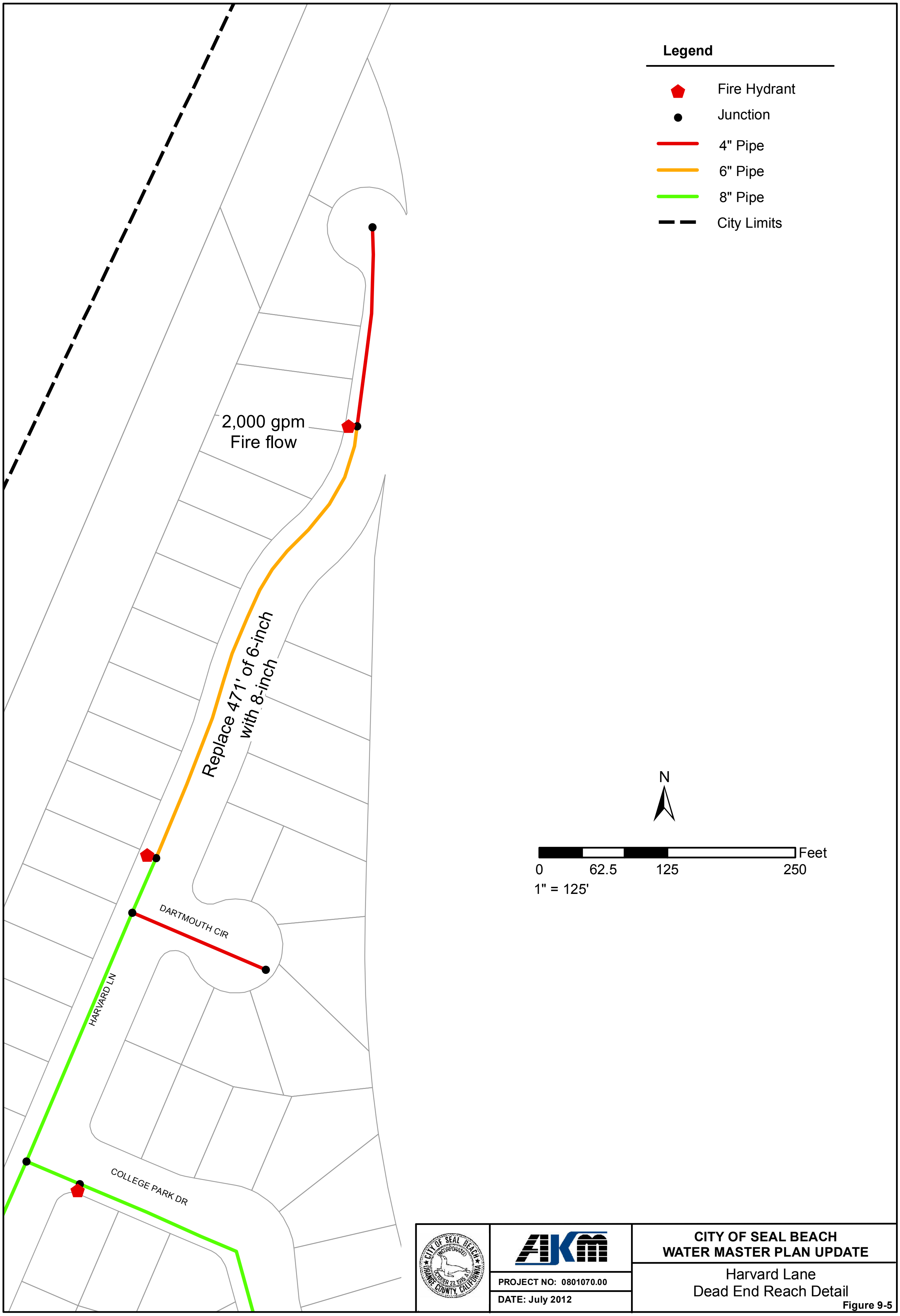
The maximum day plus fire flow run resulted in one (1) deficiency (failure to meet model junction pressure of 26 psi).

The residential fire flow demand of 2,000 gpm cannot be provided at the 6-inch dead end on Harvard Lane, north of Dartmouth Circle, as illustrated on Figure 9-5. At this location the model estimates that, there is approximately 1,500 gpm available at 26 psi. Fire flow testing in this area confirms that the City cannot provide the required fire flow at this location. The City is capable of providing the required fire flow when the following improvements are provided:

- Provide an emergency connection with the City of Long Beach at College Park Drive, west of the San Gabriel River
- Replace 471 feet of 6-inch with 8-inch pipe

While the Sunset Aquatic Park is not able to provide a fire flow of 4,000 gpm for commercial land use, it has been determined that the actual required fire flow is significantly less than this value. There is a dead end line that extends from Pacific Coast Highway to the Sunset Aquatic Park. The marina provides multi vessel launch ramps, storage, shipyard, restroom and laundry facilities, and a recreational park area. There are five small permanent structures located at this site, with a maximum floor area of 5,000 square feet. Based on the California Fire Code, a structure of this size would require a fire flow of 2,000 gpm. See Table 7-3. At 26 psi, the hydraulic model estimates that 2,450 gpm will be available at the park during a fire flow event, which is greater than the required fire flow. The City plans to abandon the existing pipe under the Anaheim Bay and connect the Sunset Aquatic Park to the City of Huntington Beach’s water system. A minimum fire flow of 2,000 gpm must be available, after the Seal Beach connection is abandoned.

The residential fire flow demand of 2,000 gpm cannot be provided at the 8-inch dead end pipe on Surfside Avenue between Carr Drive and Anderson Street; however the emergency connection with the City of Huntington Beach may be used in the event of a fire. Currently the emergency connection is typically closed and must be opened manually. This location is detailed on Figure 9-5. At the hydrant 930’ southeast of Carr Drive, the fire flow requirement of 2,000 gpm cannot be provided when the emergency connection is closed. According to the hydraulic model, the City is capable of providing only 1,480 gpm near the connection to Huntington Beach, at Surfside Drive and Anderson Street. If 1,792 feet of 8-inch PVC is replace with 10-inch PVC, between Carr Drive and Anderson Street, the City will be able to provide the 2,000 fire flow requirement. However, the water age would increase in the larger pipe at this location. The City can provide the required fire flow, when the emergency connection with the City of Huntington Beach is manually opened in a fire flow even. It is recommended that the City provide a two-way automatic connection with the City of Huntington Beach, which would automatically open to provide supplemental fire flows when the City’s system pressures drop below a predetermined pressure setting.



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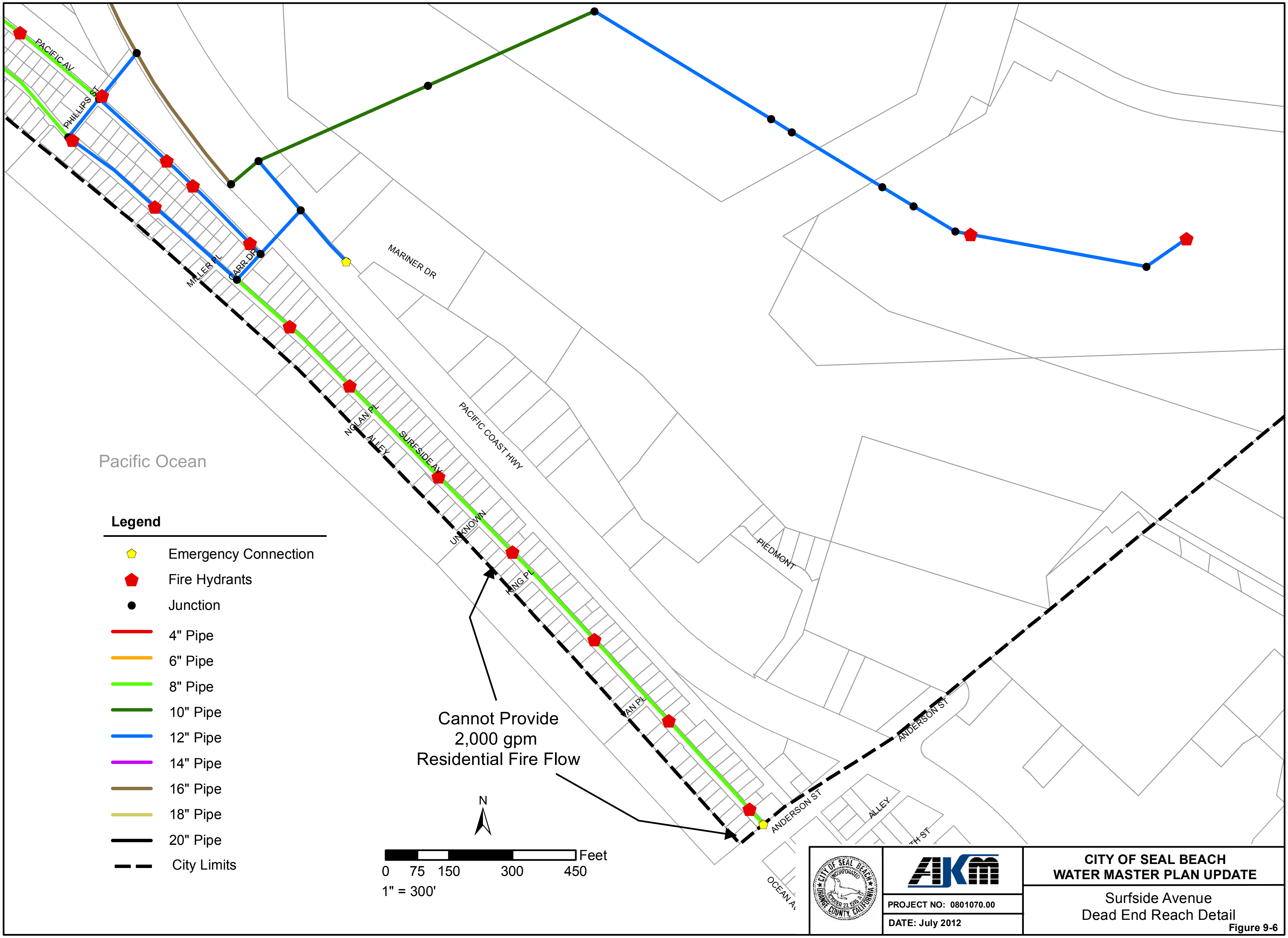
Harvard Lane
Dead End Reach Detail

Figure 9-5



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Surfside Avenue
Dead End Reach Detail

Figure 9-6

9-5 Transmission and Distribution System

The existing distribution pipes are generally well looped throughout the system, providing redundancy as well as reliability.

Pipe Velocity

The system velocities are generally within an acceptable range during the average and maximum day demand periods. During maximum day demands, the maximum velocity is almost 6.2 ft/s near the northern Leisure World connection and meter, which is slightly greater than the 6 ft/s criteria.

Minor velocity deficiencies are experienced during maximum day plus fire flow analyses. The existing 8-inch suction and discharge pipes at Navy Booster Pump Station may experience velocities greater than the 10 fps criteria, if a 4,000 gpm fire flow is required in the southern portion of the City.

Other velocity deficiencies exist at dead end pipes with fire flows. The following locations may experience velocity greater than 10 fps:

- 6-inch and 8-inch pipe on Harvard Lane, north of College Park Drive with 2,000 gpm fire flow
- 8-inch pipe on Surfside Drive, south east of Carr Drive with 2,000 gpm fire flow

Expected Useful Lives

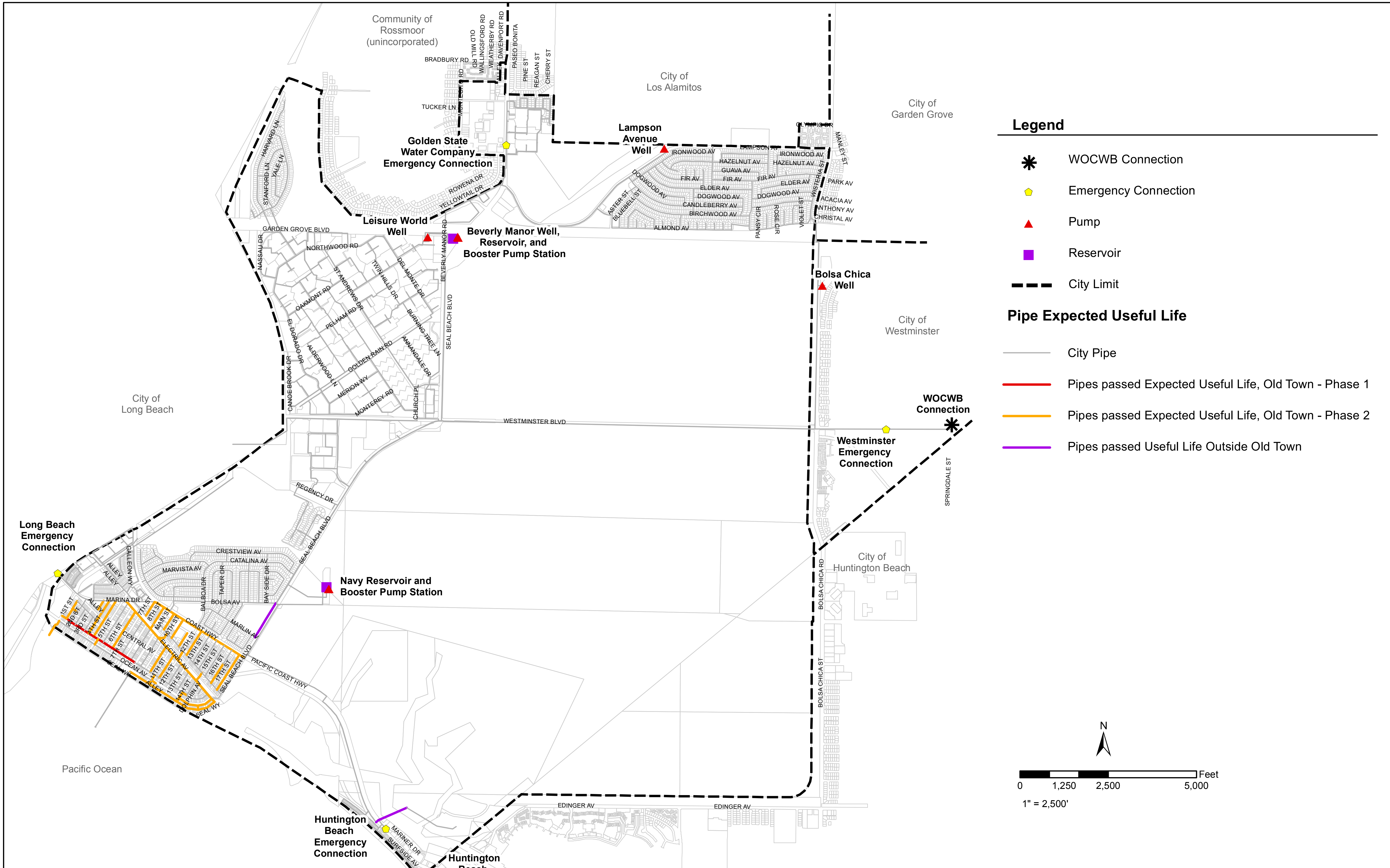
The expected useful lives of the City's pipes are categorized by material and year of installation as detailed in Table 9-2 and on Figure 9-7. Approximately 29,189 feet (5.5 miles or 8% of the total system) of pipe are currently older than the recommended expected useful life.

The City Staff has indicated that the facilities in the Old Town community with unknown installation dates have been improved recently and should not be recommended for condition improvements.

An aggressive annual replacement program is needed to tend to the aging pipes. Many of the pipes in the Old Town community may be over 90 years old. While the actual as-built plans for the majority of these pipes

Table 9-2
Pipeline Expected Useful Life Summary

Age of Pipe	Material	Expected Useful Life (Years)	Length (ft)
< 10 Years	Ductile Iron Pipe	75	3,631
	Mortar Lined Steel	75	8,694
	Plastic Pipe (PVC)	75	17,227
11-20 Years	Ductile Iron Pipe	75	2,202
	Plastic Pipe (PVC)	75	14,853
21-30 Years	Asbestos Cement	75	4,357
	Plastic Pipe (PVC)	75	1,220
31-40 Years	Asbestos Cement	75	63,782
	Cast Iron Pipe	30	3,315
	Ductile Iron Pipe	75	140
	Mortar Lined Steel	75	5,249
41-50 Years	Asbestos Cement	75	162,469
	Cast Iron Pipe	30	948
	Ductile Iron Pipe	75	86
	Mortar Lined Steel	75	25,899
51-60 Years	Asbestos Cement	75	35,627
71-80 Years	Asbestos Cement	75	557
81-90 Years	Cast Iron Pipe	30	993
> 90 Years	Asbestos Cement	75	20,027
	Cast Iron Pipe	30	3,349
Unknown	Asbestos Cement	75	888
	Ductile Iron Pipe	75	600
	Plastic Pipe (PVC)	75	11,575
Total Length			**387,690**
Total Length of pipes currently past useful lives			**29,189**



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Pipe Expected Useful Lives

Figure 9-7

could not be located, the tract maps generally range between 1903 and 1920. The replacement program for the pipes in the Old Town community has been broken down into two (2) phases. Phase 1 is of greater priority and consists of 4,152 feet of pipe, which the City has identified as being in poor condition. Phase 2 consists of the remaining 24,795 feet of pipe in the Old Town community. The Phase 2 projects should be scheduled on a yearly basis, to accommodate the City's available budget. The City may take advantage of concurrent construction such as street paving or adjacent infrastructure work when determining the priority of the Phase 2 improvements.

There is 1,213 feet of pipe outside the Old Town community that have exceeded their expected useful lives. These pipes have been directly addressed in the Capital Improvement Program.

The City should verify the pipe material and condition of the pipes that have exceeded their expected useful lives before initiating the pipeline replacement.

Repair History

The City's water pipe repair history since 2008 has been summarized in Table 9-3. Within the past four years, the City has experienced 15 water system pipe breaks and repairs.

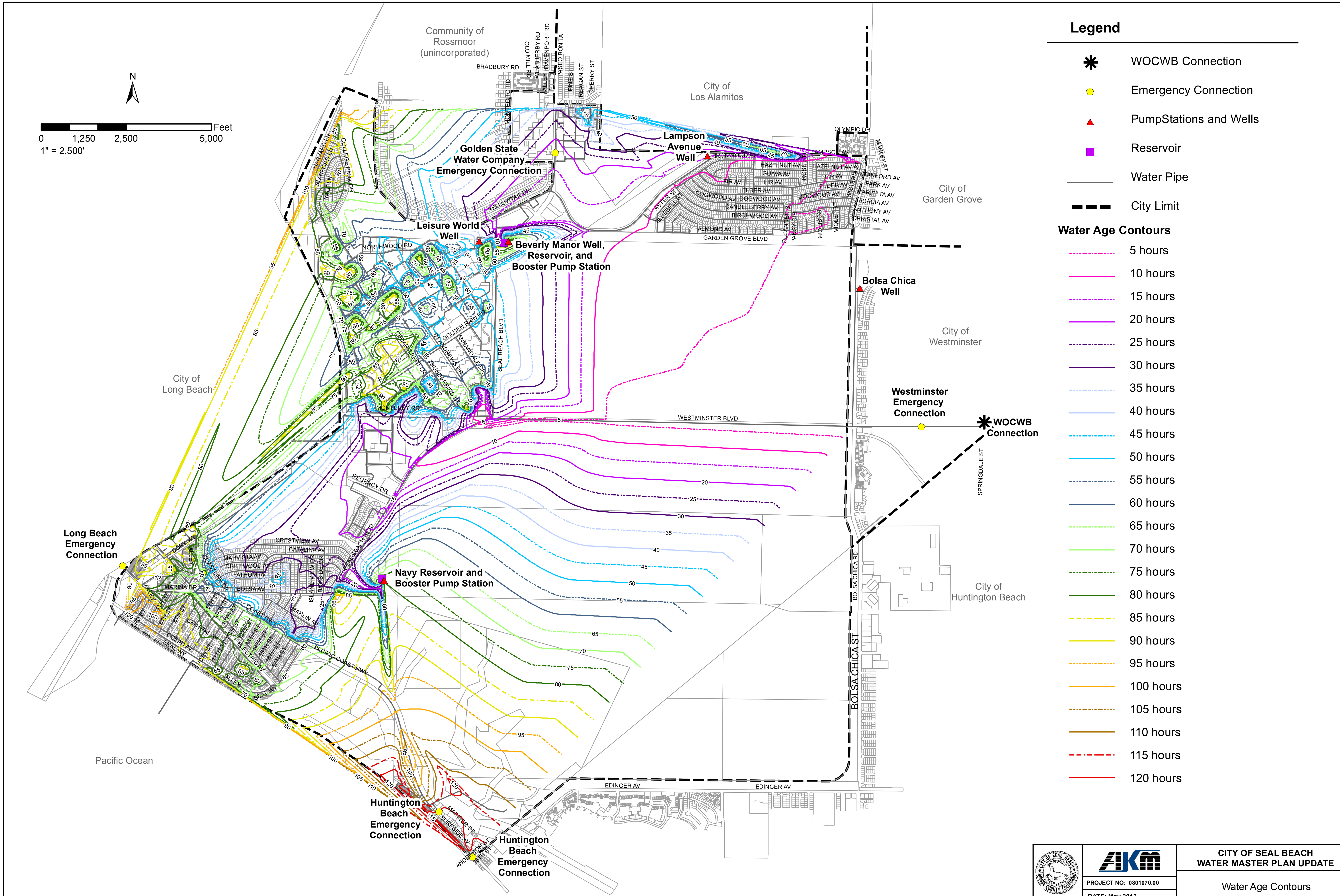
Table 9-3
Repair History

Date	Comment
8/20008	Pier Warf head and lateral
11/2008	Repair valve - trailer park
12/2008	Caltran's Meter - 3-inch Line
6/2009	10-inch main - Oakmont Road and St. Andrews Drive (Leisure World)
7/2009	Post Office
9/2009	Pier - under Ruby's Restaurant
12/2009	4th Street and Ocean Avenue
1/2010	8-inch saddle replacement Goldenrain Road (Leisure World)
5/2010	8-inch main Canoebrook Drive and El Dorado Drive (Leisure World)
5/2010	4-inch main Daisy Drive and Fir Avenue (College Park East)
11/2010	8-inch gate valve Leak - Oakwood Apartments
12/2010	8-inch main (Leisure World)
2/2011	4-inch fire service - Pier
4/2011	18-inch main - Westminster Avenue
9/2011	10-inch main - Astor Street (College Park East)

9-6 Water Age Analysis

The existing system model was used to determine the age of the water in the system. Water that remains in a reservoir or in an oversized pipe for an extended period of time may be susceptible to water quality problems such as trihalomethanes (TTHM) , haloacetic acids(HAA5), and nitrification.

The hydraulic model was utilized to determine the water age in the system. The existing water system was analyzed during the average day demand scenario. The model was operated for 1,680 hours to allow the water to circulate through the system. During average day demand scenario, the City will typically utilize its groundwater supply. For the water age analysis, the hydraulic model was set to operate the Bolsa Chica Well, Navy Booster Pump Station, Beverly Manor Well and Booster Pump Station. As determined appropriate from the City's SCADA records, the supply from the Navy Booster Pump Station and Beverly Manor Pump Station were adjusted in the model to a daily average water production of approximately 350 gpm and 570 gpm respectively. The average water age in the Navy Reservoir and Beverly Manor Reservoir were estimated as 80 hours and 84 hours, respectively. In general, the water at the Navy Reservoir will turnover every 3.3 days. The Beverly Manor Reservoir will have a turnover rate of 3.5 days.


Legend
WOCWB Connection
Emergency Connection
PumpStations and Wells
Reservoir
Water Pipe
City Limit
Water Age Contours
5 hours
10 hours
15 hours
20 hours
25 hours
30 hours
35 hours
40 hours
45 hours
50 hours
55 hours
60 hours
65 hours
70 hours
75 hours
80 hours
85 hours
90 hours
95 hours
100 hours
105 hours
110 hours
115 hours
120 hours
N
Feet
0 1,250 2,500 5,000
1" = 2,500'
Community of Rossmoor (unincorporated)
City of Los Alamitos
City of Garden Grove
City of Westminster
City of Long Beach
City of Huntington Beach
Pacific Ocean
Golden State Water Company Emergency Connection
Lampson Avenue Well
Leisure World Well
Beverly Manor Well, Reservoir, and Booster Pump Station
Bolsa Chica Well
Westminster Emergency Connection
WOCWB Connection
Long Beach Emergency Connection
Navy Reservoir and Booster Pump Station
Huntington Beach Emergency Connection
Huntington Beach Emergency Connection
WESTMINSTER BLVD
BOLSA CHICA ST
EDINGER AV
GARDEN GROVE BLVD
PACIFIC COAST HWY
SEAL BEACH BLVD
SPRINGDALE ST
CITY OF SEAL BEACH
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Water Age Contours
Figure 9-8

The average water age contours were developed for the distribution system as illustrated on Figure 9-8. The model estimated that the greatest average water age was approximately 126 hours in the Sunset Beach community. From the introduction into the City's system from the City's wells, it is anticipated that it will take approximately 5.3 days to circulate the water to the Sunset Beach community, which is located the furthest from the City's wells.

The City is in compliance with all Federal and State water quality standards, including those for TTHM and HAA5, which indicate that the City does not have any problems with water age in the system.

9-7 Water System Maintenance

The City's current water system maintenance consists of hydrant flushing, hydrant maintenance, and valve exercising. Currently, the City is flushing and maintaining its hydrants twice a year.

The City's valve exercising program is currently set at a 2-year cycle to ensure that the valves are functional. The City's 28 blow off valves and 67 air valves are maintained annually.

SECTION 10

CAPITAL IMPROVEMENT PROGRAM

10-1 Introduction

The Capital Improvement Program (CIP) consists of projects that will enhance the system to meet the established criteria, properly maintain the system's assets, and replace the facilities that have reached the end of their expected useful lives. The goal of the CIP is to provide the City with a long-range planning tool that will allow construction of the recommended projects in an orderly manner to improve the existing system and provide for any future growth. In order to accomplish this goal, it is necessary to determine the estimated cost of the needed water system improvements identified in this study, establish a basis and prioritize each of the projects. The recommended CIP is shown in Table 10-1. Project locations are shown on Figure 10-1.

10-2 Cost Estimates

Cost estimates have been prepared for each recommended project, based upon information from recent similar projects. The pipeline replacement costs are generally based upon $50 per diameter inch per foot for the Old Town area and $35 per diameter inch per foot for the remaining areas of the City. The City of Seal Beach is mostly developed, and there are many existing utilities to consider in future pipeline replacement projects. Therefore, the costs of replacing water facilities will be generally higher than in an area that is undeveloped. Construction costs can be expected to fluctuate as changes occur in the economy. These costs should therefore be reevaluated and updated annually based upon Engineering News Record (ENR) Index for the Los Angeles area (ENRLA), with the base ENRLA Index of 10,300 for June 2012.

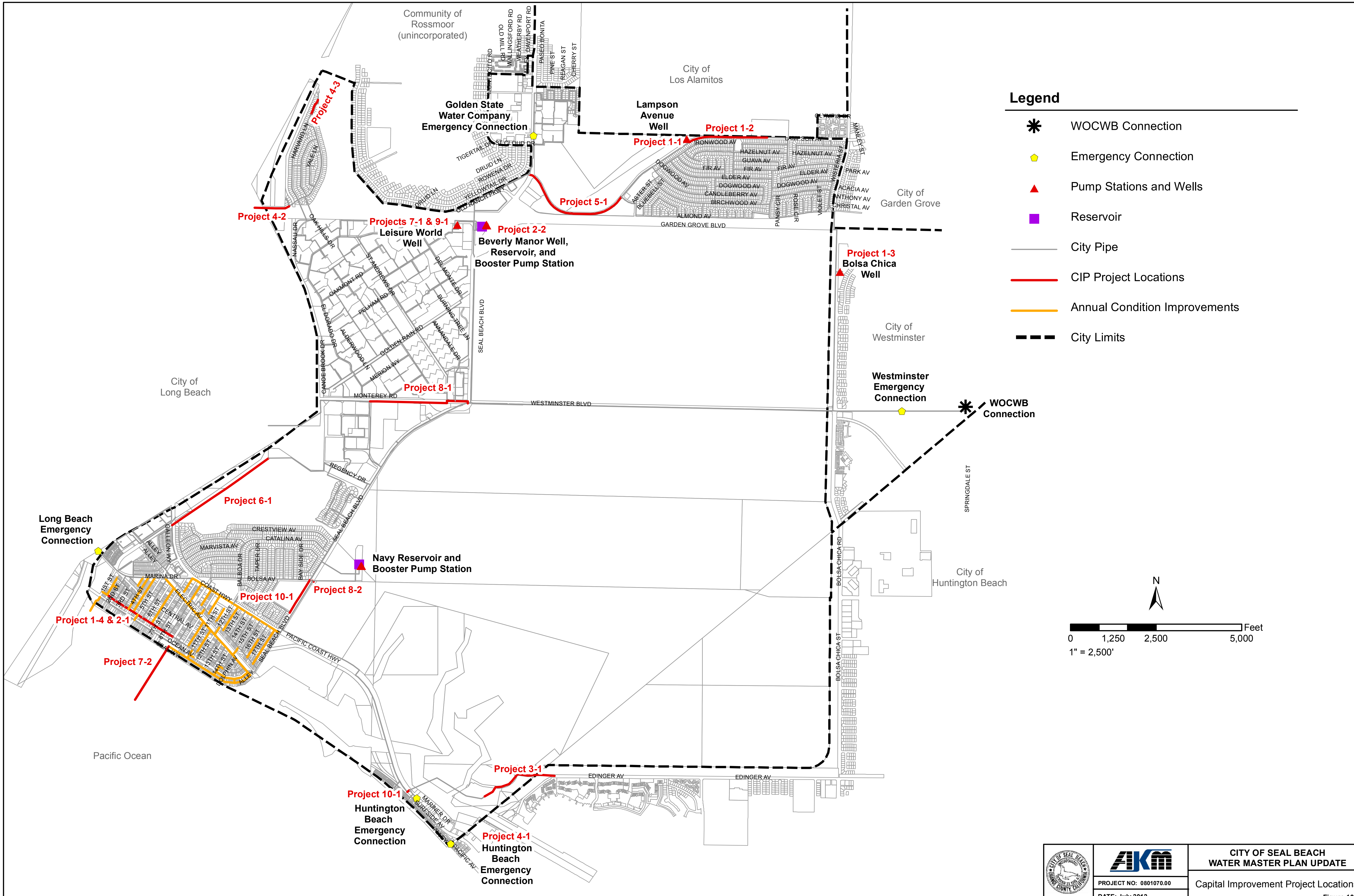
It should be noted that some of the improvements recommended herein are conceptual in nature, based on existing planning information. Therefore, they should not be considered as absolute for final design. Further analysis and refinement will be necessary prior to commencing work on the final plans, specifications and estimates package for each project. **Detailed preliminary design studies should be prepared to select the final design projects.**

The cost estimates that follow were generated by estimating the quantities of required items for each improvement, and applying typical unit prices to obtain the total estimated construction costs. An amount equal to 40 percent is added to the construction cost estimates to cover contingencies, project design, administration, and construction duration services. The resultant sum is the total estimated project cost. Cost estimates for each recommended project are shown in Table 10-1. The total Capital Improvement Program cost is estimated at $33,531,000.

10-3 Project Priorities

The primary consideration in establishing project priorities for the capital improvement program must always be given to the health, safety and welfare of the public and the customers.

The projects recommended in this report and their estimated costs were examined and sorted. Based on the criteria described herein, it is recommended that the capital improvement projects are implemented in general accordance with the schedule shown on Table 9-1. Each project is shown with its total estimated project cost. The City should review this schedule and adjust it annually to respond to changed conditions and to take advantage of concurrent construction such as street paving projects or adjacent infrastructure work.



CITY OF SEAL BEACH
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Capital Improvement Project Locations

Figure 10-1

Table 10-1
Capital Improvement Program

Year of Implementation	Project ID	Location	Justification	Pipe ID	Year of Construction	Material	Existing Size (in)	Ult. Size (in)	Length (ft)	Unit Cost ($)		Construction Cost ($)	Total Cost ($)
2012	1-1	Lampson Avenue Well 750KW Emergency Generator	Source of Supply Reliability	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	300,000	Each	**$300,000**	**$420,000**
2012	1-2	Lampson Avenue Well Discharge Piping - Lampson Avenue, between Lampson Avenue Well and east of Heather Street	Source of Supply Reliability	New	N.A.	N.A.	N.A.	12	1,326	35	Diam/in/LF	$556,920	$779,688
								8	979	35	Diam/in/LF	$274,120	$383,768
		Totals							**2,305**			**$831,040**	**$1,163,456**
2012	1-3	Bolsa Chica Well SCADA Improvement	Asset Maintenance	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	30,000	Each	$30,000	$42,000
		Bolsa Chica Well 400 HP Motor Replacement	Asset Maintenance	1995	N.A.	N.A.	N.A.	N.A.	N.A.	125,000	Each	$125,000	$175,000
		Totals							**0**			**$155,000**	**$217,000**
2012-2013	1-4 & 2-1	Old Town Water Line Replacement, Phase 1 -Ocean Alley Improvement	Age/ Condition	P3662	1903	CIP	6	8	127	50	Diam/in/LF	$50,858	$71,202
				P3260	1903	CIP	4	8	140	50	Diam/in/LF	$56,035	$78,449
				P3660 P3552 P3550 P3530 P3492 P3490 P3480 P3370 P3362 P3360 P3310 P3482	1903	ACP	8	8	2,042	50	Diam/in/LF	$816,964	$1,143,749
		Totals							**2,310**			**$923,857**	**$1,293,400**
2013	2-2	Beverly Manor Reservoir Access Hatch and Ladder	Asset Maintenance	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	40,000	Each	$40,000	$56,000
		Beverly Manor Booster Pump Station and Well Improvements	Asset Replacement	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3,200,000	Each	$3,200,000	$3,200,000
		Leisure World Well SCADA Improvements	Asset Maintenance	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	50,000	Each	$50,000	$70,000
		Totals							**0**			**$3,290,000**	**$3,326,000**

Table 10-1 (Continued)
Capital Improvement Program

Year of Implementation	Project ID	Location	Justification	Pipe ID	Year of Construction	Material	Existing Size (in)	Ult. Size (in)	Length (ft)	Unit Cost ($)		Construction Cost ($)	Total Cost ($)
2014	3-1	Sunset Aquatic Park Connection	Secondary supply to unreliable waterline under Anaheim Bay, possibly transfer service to Huntington Beach	New	N.A.	N.A.	N.A.	12	2,000	35	Diam/in/LF	$840,000	$1,176,000
								12" Bridge Crossing	400	1,000	LF	$400,000	$560,000
								Connection	N.A.	100,000	Each	$100,000	$140,000
		Totals							**2,400**			**$1,340,000**	**$1,876,000**
2015	4-1	Huntington Beach Automatic Connection	Redundancy	N.A.	N.A.	N.A.	N.A.	Connection	N.A.	200,000	Each	**$200,000**	**$280,000**
2015	4-2	College Park West Emergency Connection to Long Beach system	Provide service during outage of City supply pipes	New	N.A.	N.A.	N.A.	8	700	35	Diam/in/LF	$196,000	$274,400
								8" Bridge Crossing	400	1,000	LF	$400,000	$560,000
								Connection	N.A.	100,000	Each	$100,000	$140,000
		Totals							**1,100**			**$696,000**	**$974,400**
2015	4-3	Harvard Lane, north of College Park Drive	Fire Flow Deficiency	P6014	1971	ACP	6	8	471	35	Diam/in/LF	**$131,897**	**$184,656**
2016	5-1	Lampson Avenue, between Seal Beach Boulevard and Basswood Street	Age/ Condition	P1000 P1010 P1020 P1030 P1040	1979	Mortar Lined Steel Cylinder	12	16	3,406	35	Diam/in/LF	**$1,907,631**	**$2,670,683**
2017	6-1	Pacific Coast Highway and OCFCD Los Alamitos Retarding Basin	Age/ Condition	P7430 P7440 P7450 P7452	1968	Mortar Lined Steel Cylinder	18	18	3,420	35	Diam/in/LF	**$2,154,715**	**$3,016,601**
2018	7-1	Leisure World Well Discharge Piping	Age/ Condition	N.A.	1962	ACP	12	12	77	35	LF	$32,340	$45,276
				N.A.	1962	N.A.	N.A.	Sand Separator	N.A.	100,000	Each	$100,000	$140,000
		Totals							**77**			**$132,340**	**$185,276**
2018	7-2	Old Town Water Line Replacement, Phase 1 - Pier Fire Line	Condition	P3060	1974	Mortar Lined Steel	6	8	1,842	50	Diam/in/LF	$736,967	**$1,031,754**
2019	8-1	Westminster Boulevard Water Line Replacement, from Seal Beach Boulevard to Apollo Drive	Condition	P7340 P7350 P7342 P7364	1968	ACP	12	12	725	35	Diam/in/LF	$304,419	$426,187
				P7360 P7362 P7364	1968	Mortar Lined Steel Cylinder	18	18	2,249	35	Diam/in/LF	$1,416,870	$1,983,618
		Totals							**2,974**			**$1,721,289**	**$2,409,805**

Table 10-1 (Continued)
Capital Improvement Program

Year of Implementation	Project ID	Location	Justification	Pipe ID	Year of Construction	Material	Existing Size (in)	Ult. Size (in)	Length (ft)	Unit Cost ($)		Construction Cost ($)	Total Cost ($)
2020	9-1	Leisure World Well Pump and 250 HP Motor Replacement	Asset Maintenance	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	300,000	Each	$300,000	$420,000
2021	10-1	Aged Water Line Replacement, Outside Old Town	Age/ Condition (CIP)	P4902	1972	CIP	10	10	1,137	35	Diam/in/LF	$398,006	$557,208
				P8090	1968	CIP	10	10	76	35	Diam/in/LF	$26,600	$37,240
		Totals							**1,213**			**$424,606**	**$594,448**
Annual	Annual	Old Town Water Line Replacement - Phase 2 Annual Condition Replacements	Age/ Condition (CIP)	Varies	Varies		4	8	422	50	Diam/in/LF	$168,650	$236,110
							6	8	11,821	50	Diam/in/LF	$4,728,583	$6,620,016
							8	8	9,425	50	Diam/in/LF	$3,769,826	$5,277,757
							12	12	3,127	50	Diam/in/LF	$1,876,233	$2,626,726
		Totals							**24,795**			**$10,543,292**	**$14,760,609**
								Grand Total	**45,842**			**$24,864,778**	**$33,530,689**

Capital Improvement Project Descriptions

Project No. 1-1 – Lampson Avenue Well, Emergency Generator

A generator room was included in the construction of the Lampson Avenue Well. It is recommended that the City equip the facility with a 750 KW emergency diesel generator to operate the well when commercial power is out.

The estimated cost of this project is $420,000. This project is expected to be completed in the 2012 calendar year.

Project No. 1-2 – Lampson Avenue Well Discharge Piping

The proposed 12-inch (1,326 feet) and 8-inch (979 feet) diameter pipe will connect the Lampson Avenue Well to the existing 8-inch facility, which terminates at 4665 Lampson Avenue.

The estimated cost of this project is $1,163,000. This project is expected to be completed in the 2012 calendar year.

Project No. 1-3 – Bolsa Chica SCADA Upgrades and Motor Replacement

It is recommended that the City convert its existing landline emergency communication system to a complete antenna and radio SCADA system.

It is also recommended that the City replace its existing 400 HP motor, which has reached the end of its expected useful life.

The estimated cost of this project is $217,000. This project is expected to be completed in the 2012 calendar year.

Project Nos. 1-4 and 2-1 – Old Town Water Line Replacement Program – Phase 1

As discussed in Subsection 9-4, approximately 8% of the City's distribution pipes have reached the end of their expected useful lives. The City has been proactive in replacing the pipes in Old Town, where the original water lines date back to 1903. The Phase 1 improvements include 2,310 feet of pipe identified as being of higher priority than the other pipes in Old Town.

These lines have reached the end of their expected useful life and should be replaced with of 8-inch PVC.

The estimated cost of this project is $1,293,000. This project is expected to be completed as two projects during the 2012 and 2013 calendar years.

Project No. 2-2 – Beverly Manor Booster Pump Station and Well Improvements

The Beverly Manor Well and Pump Station improvements will include new electrical equipment, SCADA system, pumps, discharge piping, 350 KW emergency natural gas generator, one (1) 150 HP VFD operated electric motor, and two (2) 75 HP VFD operated electric motors. The design plans for these improvements have been completed.

It is recommended that the City install an additional access hatch and ladder near the inlet pipe, located on the south west side of the reservoir when the improvements at the Beverly Manor Well and Pump Station are implemented.

It is also recommended that the City convert its existing landline emergency communication system at the Leisure World Well to a complete digital signal transmission SCADA system. The system shall integrate these improvements to the SCADA base station at the City's Adolfo Lopez Corporate yard.

The estimated cost of this project is $3,326,000. This project is expected to be completed in the 2013 calendar year.

Project No. 3-1 – Sunset Aquatic Park

The City provides service to the Sunset Aquatic Park, located north of Pacific Coast Highway and west of Bolsa Chica Channel. Currently, the City serves the Sunset Aquatic Park through a 10-inch CIP that crosses below the Anaheim Bay. Constructed in 1968, this facility has passed the end of its expected useful life. It would be very difficult and costly to replace this line. Seal Beach has been in communications with the City of Huntington Beach to serve the park through the City of Huntington Beach's system. The project will consist of constructing a 12-inch water main from the end of the existing facility to the flood control channel bridge at the Huntington Beach's city boundary. It is also recommended that the City construct three (3) fire hydrant assemblies at this location.

The estimated cost of this project is $1,876,000. This project is expected to be completed in the 2014 calendar year.

Project No. 4-1 – Huntington Beach Automatic Two-Way Connection

It is recommended that the City install a two-way automatic connection with the City of Huntington Beach at Pacific Avenue and Anderson Street. There is currently an emergency connection at this location; however, it must be opened manually to serve the City. The recommended connection will automatically provide additional water from the City of Huntington Beach when the City's system pressures drop below a predetermined pressure setting.

The City is not able to provide the required 2,000 gpm fire flow service to the residents in the Surfside community on Surfside Avenue, due to the long 8-inch dead end pipe that terminates at the existing emergency connection at Anderson Street. The two way automatic connection would automatically open to provide the necessary additional fire flow during an emergency situation.

The estimated cost of this project is $280,000. This project is expected to be completed in the 2015 calendar year.

Project No. 4-2 – College Park West Connection

There are currently two (2) 8-inch ACP that extend from the Leisure World community below the Garden Grove Freeway onramp and off ramp crossings. In the event that there is a break at this bottleneck, the College Park West community would not have an adequate source of water.

An 8-inch line should be extended to the City of Long Beach system along College Park Drive westerly from Loyola Plaza to the west side of San Gabriel River Bridge to an emergency connection with the City of Long Beach.

The estimated cost of this project is $974,000. This project is expected to be completed in the 2015 calendar year.

Project No. 4-3 – Harvard Lane Water Line Replacement

It is recommended that the City replace 471 feet of 6-inch pipe on Harvard Lane, north of Dartmouth Circle. To increase the fire flow at this dead end reach, it is recommended that the pipe be increased to 8-inch in diameter.

The estimated cost of this project is $185,000. This project is expected to be completed in the 2015 calendar year.

Project No. 5-1 – Water Line Replacement in Lampson Avenue, between Seal Beach Boulevard and Basswood Street

The 12-inch line mortar lined steel cylinder pipe (3,406 feet) is in poor condition and is experiencing leaks and deterioration. It should be replaced with a new 16-inch pipe.

The estimated cost of this project is $2,671,000. This project is expected to be completed in the 2016 calendar year.

Project No. 6-1 – Replace 18-inch Steel Pipe between Pacific Coast Highway and the OCFCD Los Alamitos Retarding Basin

The existing 18-inch mortar lined steel cylinder pipe (3,420 feet) has experienced significant corrosion. This line provides a secondary supply route to the southerly portion of the system, which is necessary if there is a failure in the two (2) 12-inch distribution lines in Seal Beach Boulevard. This water line improvement will require coordination with the Los Cerritos Wetlands Authority. This pipe should be replaced with a new 18-inch pipe.

The estimated cost of this project is $3,017,000. This project is expected to be completed in the 2017 calendar year.

Project 7-1 – Leisure World Well Discharge Piping Replacement

The Leisure World Well discharge piping has reached the end of its expected useful life. The existing piping should be replaced.

The estimated cost of this project is $185,000. This project is expected to be completed in the 2018 calendar year.

Project 7-2 – Pier Fire Water Line Replacement

The existing 6-inch fire line along the pier is in poor condition. While this facility has not reached the end of its expected useful life, the pipe and fittings have deteriorated significantly and should be scheduled for replacement.

The estimated cost of the projects is $1,032,000. This project is expected to be completed in the 2018 calendar year.

Project 8-1 – Westminster Boulevard Water Line Replacement

The existing 18-inch mortar lines steel cylinder and 12-inch ACP pipes on Westminster Boulevard between Seal Beach Boulevard and Apollo Drive have experienced multiple breaks in past several years. While these pipes have not reached the end of their expected useful life, they should be scheduled for replacement.

The estimated cost of the projects is $2,410,000. This project is expected to be completed in the 2019 calendar year.

Project 9-1 – Leisure World Well Pump and Motor Replacement

The pump and 250 HP motor are approximately 15 years old and are nearing the end of their expected useful lives.

The estimated cost of this project is $420,000. This project is expected to be completed in the 2020 calendar year.

Project 10-1 – Aged Water Line Replacement, Outside Old Town

As discussed in Subsection 9-4, approximately 8% of the City's distribution pipes have reached the end of their expected useful lives. The majority of these improvements is within the Old Town community and should be scheduled for repair on an annual basis.

The remaining pipes include the following:

- 10-inch CIP pipe, located on Seal Beach Boulevard, south of Bolsa Avenue
- 10-inch CIP pipe, located Pacific Coast Highway, north west of Carr Drive

The estimated cost of this project is $594,000. This project is expected to be completed in the 2021 calendar year.

Annual Condition Improvement Projects

As discussed in Subsection 9-4, approximately 8% of the City's distribution pipes have reached the end of their expected useful lives. The Old Town Phase 2 improvement projects consist of 24,795 feet of pipe. The Phase 2 reaches should be scheduled on a yearly basis, to accommodate the City's available budget. The City may take advantage of concurrent construction such as street paving or adjacent infrastructure work when determining the priority of the Phase 2 improvements.

The City should verify the pipe material and condition of the pipes that have exceeded their expected useful lives before initiating the pipeline replacement.

The estimated cost of this project is $14,761,000. These projects are recommended to be scheduled on a yearly basis.

Continuous – Geographic Information System Maintenance, Minor Projects, and Capital Project Management

This will be an ongoing project which will maintain an up-to-date map of the system as well as attribute and maintenance data. It will aid the City to maintain its water system assets.

This item will also provide funding for unanticipated project that may be required as a result of other activities.

Funding for work needed for management of the capital improvement projects is also included in this item.

The estimated cost of this project is $150,000 per year.